RAILWAY ENGINEERING AND MAINTENANCE OF WAY.
WITH WHICH IS INCORPORATED
THE ROADMASTER AND FOREMAN
BRIDGES-BUILDINGS-CONTRACTING-SIGNALING-TRACK
Published by THE RAILWAY LIST COMPANY

WILLIAM E. MAGRAW, Pres. and Treas.
CHAS. S. MYERS, Vice-Pres.
C. C. ZIMMERMAN, Bus. Mgr.
J. M. CROWE, Mgr. Central Dist.
LYNDON F. WILSON, Managing Editor.
KENNETH L. VAN AUKEN, B.S.C.E., Assoc. Ed.
OWEN W. MIDDLETON, B. S. M. E., Assoc. Ed.
WARREN EDWARDS, 2d V. P. & Assoc. Ed.

Office of Publication: Manhattan Building, Chicago
Telephone, Harrison 4948
Eastern Office: 50 Church Street, New York
Telephone, Cortlandt 5765
Central Office: 403 House Bldg., Pittsburg

A Monthly Railway Journal

Devoted to the interests of railway engineering, maintenance of way, signaling, bridges and buildings.
Communications on any topic suitable to our columns are solicited.
Subscription price, $1.00 a year; to foreign countries, $1.50, free of postage. Single copies, 10 cents. Advertising rates given on application to the office, by mail or in person.
In remitting, make all checks payable to the Railway List Company.
Papers should reach subscribers by the twentieth of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.

Entered as Second-Class Matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

New Series, Vol. 7
Old Series, Vol. 26
Chicago, May, 1911 No. 5

CONTENTS.

Editorial—
Announcement 243
Creosoting 243
Railway Cross Ties 244
Railway Grades 245
Creosoting 246
Specifications for "A" Grade Vitrified Clay Product 249
Eating House at Booneville 251
Use of Diagrams for Solving Engineering Formula 252
Desplaines Valley Railway 256
Mt. Union Tie Treating Plant 259
Salisbury Viaduct, Western Maryland Railway 260
Scale Embodying New Features in Design 262
Fortune for Removing Wreck 263
The Signal Department 264
Editorial 264
Railway Signal Standards No. 17, the Southern and Union Pacific 264
Portable Storage Batteries for Automatic Signals, Harriman Lines 269
Electric Railway Block Signaling 272
The Maintenance of Way Department 275
Square or Broken Joints (on Tangents) 275
Railway Construction 276
New Literature 277
Personals 277
With the Manufacturers 278
Railway Station Sealing 279
Concrete Mixer Transportation by Automobile 279
Mechanical Coaling Station 279
Industrial Notes 281
Recent Engineering and Maintenance of Way Patents 282

Announcement.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY has purchased the ROADMASTER AND FOREMAN and with this issue they are merged. Subscribers to both journals will appreciate this consolidation as it means more for the same amount of money, the subscription price remaining at $1.00 per year. Subscribers to the ROADMASTER AND FOREMAN will receive the improved journal to the expiration of their subscription without extra charge. The larger circulation and improved editorial matter of the combined journals will give advertisers far better value and service than heretofore.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY will continue to be the name of the combined journals. The growth of this journal, both in circulation and advertising, has been phenomenal since its purchase by the RAILWAY LIST CO., less than two years ago. RAILWAY ENGINEERING AND MAINTENANCE OF WAY now has a greater paid circulation in the engineering department of railroads than any other journal published. This means that the manufacturer who desires to reach the engineering department can do so more effectively, without waste circulation and at a less cost per thousand of circulation in RAILWAY ENGINEERING AND MAINTENANCE OF WAY, than is otherwise possible. The idea of confining a magazine to one particular class of readers, all of whom are interested in its editorial columns continues to grow in favor. Our success as publishers of RAILWAY ENGINEERING AND MAINTENANCE OF WAY for the engineering department and the RAILWAY MASTER MECHANIC for the car and motive power departments has proved the logic of this plan. It means elimination of waste circulation for the advertiser and a closer, deeper interest in all the matter contained in each issue by the subscriber. It approaches most nearly the ideal technical magazine.

Creosoting.

IN THE ARTICLE on creosoting on another page we note that artificial or steam seasoning of wood to be treated, is advocated. Steam seasoning, it is claimed, will not cause the wood to check or crack to any great extent, and the saving in time will compensate for the slight increase in cost over the weather seasoning process. In steam seasoning there is no liability of rotting, as in air seasoning. The idea that the ties should be seasoned after treatment in order to get the best results is somewhat new, and, of course, is opposed in general as taking too much time.

Herein lies a fault with the ordering of much material for railway construction. Permission to go ahead on construction jobs is frequently held back and postponed, and then given and the work rushed to completion to make up for the time wasted. The result is frequently a waste of money in wages paid to construction organizations which are accomplishing nothing before the job is started. After the job is commenced endless delays and trouble is caused by the non-arrival of material. Undoubtedly money can be saved by pushing a job if the material is to be had. But to rush a part of the work and then wait for weeks for material is assuredly not a saving.

There is, of course, the other extreme: Unused or stored material represents non-interest paying capital. Such losses will be comparatively small unless a job is postponed for a year, or several years, after the material has been ordered

beyond recall. Such postponements are usually caused by business conditions or apprehension as to adverse legislation. If relieved of such conidtions the engineering construction department could undoubtedly produce cheaper and better work.

RAILWAY CROSS TIES.

By K. L. Van Auken, Assoc. Editor.

Railway ties on the market today may be divided into three general classes: wood, steel and concrete. Some designs are a combination of two or even three of the above classes. Disregarding species, wood ties may be divided into the two classes: i. e., ties in their natural condition, and ties treated by a process to increase their physical life. Steel ties have various forms, I-beam shapes, trough shapes, etc. Concrete ties are reinforced with steel, and have a variety of shapes.

The concrete tie, if properly reinforced, presents a body of requisite strength, and one which is practically corrosion proof. It seems that no tests have been carried on with these ties for a sufficient time to cause destruction or disintegration by natural agents. There is, however, a question as to whether or not these ties will not be gradually broken up by the continual impact of passing trains. It is held by some authorities that such a tendency exists in reinforced concrete viaducts under heavy traffic. Concrete ties, being much heavier than track ties, serve to form a more unyielding track foundation. A question has been raised as to the advisability of using rock ballast, as some people claim it makes too solid a road bed, and the same question could be raised with regard to the concrete tie. It is claimed that with a solid roadbed, the rolling stock and rails must absorb practically all of the shock and wear caused by passing trains, but that an elastic roadbed absorbs part of the impact.

The provision for a somewhat elastic roadbed is shown, we believe, in recent street railway construction. Much concrete is used between and on top of the ties, but none is used under the ties.

Wooden ties have a cushion effect entirely absent in concrete ties. Some inventors have realized and made use of this cushioning property of wood, by providing concrete ties with short wooden cushions, under each rail. Where such cushions are raised above the body of the tie, there is likely to be a lack of holding power for the spike, a disadvantage such as encountered in shimmed up track. Wherever rails are shimmed up so that the base is an inch or more above the tie, track men will brace the rail against spreading. In the case of a concrete tie with wood cushions on top, the base of the rail is so far from the body of the tie that the spikes holding the rail are subjected to a strain at some distance from their rigid support and are liable to bend and allow the track to get out of gauge. If such blocks are rigidly fastened to the body of the tie, the holding power at the base of the rail is no greater than that of a wooden tie, and one of the principal advantages claimed for a concrete tie is greater gauge holding power. The great weight of a concrete tie is a disadvantage. It increases the cost and ease of handling, both before and after laying. Suppose, for instance, that concrete ties were used for laying track on a new and soft grade. Common experience has shown that raising ordinary track with wooden ties gives some trouble under such conditions, especially if trains have passed over the track. The weight of a track with concrete ties would be twice as heavy as one with wooden ties, and would offer nearly twice the resistance to the lifting jacks. The resistance to raising is increased by air pressure, if the ties are imbedded in the grade to a considerable extent. The trouble is not in the jacks being unable to lift the load, but because there is not sufficient foundation, or bearing, for the jacks. Even on an old settled grade, where the foundation is good, the jacks would have to be set at much shorter intervals in order to prevent short sags due to the heavy weight of the ties.

The use of either a steel or concrete tie in laying track with a track machine would seem entirely impracticable.

The steel tie would meet the requirements for a tie in freight and passenger yards, judging from the few tests which have been made. It has several valuable characteristics not possessed by the wood tie. (1) It has a long life. This fact makes for economy in ties, spikes, and maintenance, and also for a more efficient use of the yard. For, whenever ties must be replaced, one track or a part of a track must be temporarily put out of service, and cleared of cars. (2) The steel tie holds track absolutely to gauge, unless the fasten-
and passenger yards are frequently very sharp. This fact is
ings break. The curves in switches and tracks in freight
especially true of yards in large cities, because of limited space. Such curves cause trouble and expense on account of spreading rails and resulting derailments. Three-wheel car-trucks and large engines aggravate this trouble. Probably the most trouble is encountered on curved switch leads, or in other places where it is impossible to give the proper super-elevation to the outer rail. The steel tie would hold the gauge much better and would not have to be insulated in yards, for in general, there are no track circuits. (3) The steel tie will not burn. Many wooden ties are destroyed in yards, on account of hot cinders and ashes dumped by engines.

Insulated steel ties have been used with success on the main lines of some of our railroads, in track carrying electric current. The first cost of insulating seems not to be prohibitive, but the life of the insulation is comparatively short. The steel tie is open to the same objections as the concrete tie in being non-elastic.

The total number of wooden cross ties purchased by the railroads for the last three years is given below:

1907	153,653,000
1908	112,466,000
1909	123,751,000

At the present rate of consumption, it is estimated that our forest will be exhausted in 1940. The slump in 1908 was due to the general business depression, but in general the demand for ties is increasing very rapidly. In 1907 the average price per tie was 51c; in 1908, 50c; and in 1909, 49c. The decrease in price may possibly have been partly caused by the decreased demand, but it undoubtedly shows an increasing tendency towards the utilization of the cheaper woods. We can expect larger increases in the number of cheaper

ties used, and also in the number of such ties treated by a process to increase the physical life of the wood. For it is with the cheaper woods,—woods lacking in decay resisting qualities,—that preservative treatment shows the greater benefits.

Results of the preservation in Europe would lead us to expect a much greater lengthening of the life of a tie than is generally estimated by American authorities. European records show a lengthening of life up to four times that of the untreated tie, while two and one-half times the life of the untreated tie is about the maximum estimate in America.

Railway Grades

A railway grade is generally made level on top. When the track is laid and trains run over it before it is ballasted the ties sink into the grade a depth of several inches, depending on the compactness of the soil, amount of moisture, etc. A longitudinal section of the roadbed would then look something like Figure 1.

The dirt between the ties should be leveled off to the bottom of the ties before ballasting. Two methods might be followed: (1) The whole grade could be cut down even with the bottom of the ties and the dirt thrown over the shoulder. This would be an expensive operation. (2) The track could be raised and the dirt between the ties could be tamped in under them. This is the method usually followed, and leaves the top of the roadbed somewhat like the cross section, Fig. 2. The first method for taking care of the surplus dirt between the ties is the most expensive, but it gives a desired result, in that the top of the subgrade is level. Usually the second method is used, or else the track is surfaced without removing at all the ridges of dirt between the ties.

After the track has been ballasted, the part of the subgrade directly under the track will be compressed and settle, and this

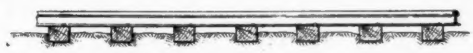


FIG. 1

FIG. 2

action will continue possibly for a number of months. So that even if the top of the grade is made level before initial ballasting, the top of the dirt subgrade will gradually assume a trough or ditch-like surface. The depth of this ditch or trough has actually been found to be from 8 to 10 inches on a grade in Illinois, from which the ballast was removed.

Ballast of nearly every kind,—gravel, cinders, crushed stone—is much more pervious to water than the dirt which is in the embankment. Rain water falling on these ballasts will soon penetrate to the dirt subgrade. If there is a basin beneath the ballast, water will be retained on top of the subgrade. If the original depressions made by the ties are left in the subgrade, the greatest accumulation of water (which will cause softening of the track foundation) is immediately beneath the tie where the greatest pressure comes and where the greatest resistance should be. The softening of the grade will tend to allow the ballast and the track to settle further and thus make the condition still worse. All water which collects in this manner must soak through the dirt of the subgrade till it finally finds an outlet. If, however, the surface of the subgrade was higher in the middle than on the shoulders or even if it were level, the water which penetrated the ballast would find a natural outlet along the top of the more impervious dirt of the subgrade.

The American Railway Engineering Association has specified that before ballasting a new track "all dirt above the bottom of the ties shall be removed." Little else is to be found on the subject. The construction engineer has probably given the matter little thought. He is usually a specialist. When he is through constructing one piece of work, he is transferred to another. He is not concerned with the maintenance of the track except for a possible short period just after construction. The construction engineer is concerned chiefly in getting the work done, or in other words, in making a record, and not (in some cases at least) in constructing a track which will be easy to maintain. The interests of the construction and maintenance department frequently conflict, so that many times there is a disinclination to try to better construction work on account of enmity or jealousy.

The usual width of roadbed for single track main line is from 18 to 20 feet and for double track from 30 to 33 feet. For double track, therefore, it is even more imperative that the surface of the subgrade be level, or better yet, slope toward the outside. The American Railway Engineering Association specifies three widths of roadbed, 14, 16 and 20 feet for single track roadbeds, but common practice seldom allows anything less than sixteen feet. The distance from the end of a tie to the edge of a 16-foot roadbed would be 4 feet; to the edge of a 20-foot roadbed would be 6 feet. A specification for a subgrade could require that the middle 10 feet of the grade be 6 or 8 inches higher than the shoulder. If the width was made

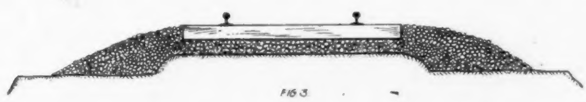


FIG. 3

less than 10 feet, the difficulty of laying track would be unduly increased.

On a grade such as suggested, the dirt above the bottom and between the ties could be used in a "dirt surface" before applying ballast to the roadbed. The bottom of the ties would in this case be well above the shoulder, and allow for a future settling beneath the ballast. Even if the track were surfaced without removing the dirt between the ties, the drainage on a grade as suggested would be much better than on the ordinary level top grade. Water collecting in the depressions left by the ties would find an easy outlet at the end. During the process of track laying and surfacing, the raised part of the sub-grade, which would extend about 1 foot beyond the end of the tie, would be rounded off. This would be desired in order to facilitate the best drainage.

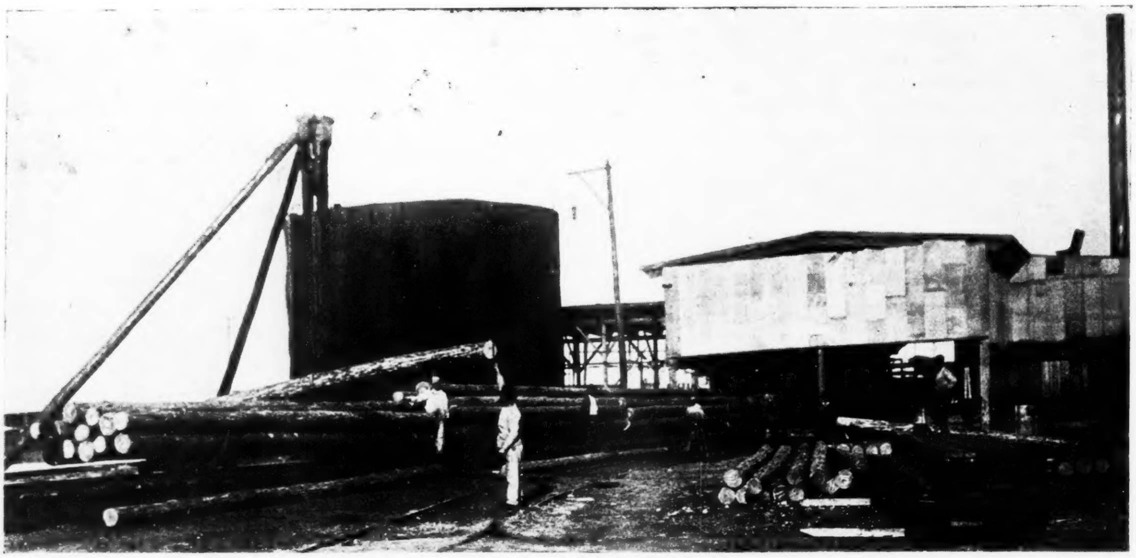
Grading is usually done by contract, and paid for by the yard. The shape and finishing of the grade is under the control of the engineer, but must be in accord with the specifications. A grade such as is described above would probably cost more for finishing, and it is possible that the railroad might be charged a slight increase per yard by the contractor in his bid. This is not certain, however, for the item of finishing is one about which there is some uncertainty in estimating. However, a small increase in initial cost would be justified if it gave a decided permanent advantage, and it is conceded that one of the first essentials for good track is good drainage. It is probable that in many cases the increased cost of finishing would fall on the contractor.

Creosoting

By F. A. Langbehn, President, Galveston Creosoting Co.

There have been so many views expressed in regard to the most efficacious treatment of timber with preservatives, hardly any two opinions agreeing even in the first essentials, that it would be difficult to formulate any given rule by which the best results might be obtained; hence I can only relate experiences which have been afforded by a daily contact with the treatment of timber for a number of years. One of the first advantages which the treatment of timber with preservatives encompasses is the rendering serviceable of an inferior timber that has little or no practical value in construction where it is exposed to the action of the elements. Then the consequent conservation of the superior woods is a consideration not to be overlooked. Everyone interested in forestry will tell you that at the present rate of cutting it will only require a comparatively few years to exhaust the natural timber resources of the United States. They would suggest that young trees be planted as those matured are cut. This plan was adopted in several countries of Europe with good effect; but much more satisfactory results would obtain if the old trees of superior fibre were allowed to stand and develop, using in their place trees which have been until recently considered of little or no value whatever. A few will admit today that "Bull" or Loblolly pine (the most inferior varieties of the pine family), can by careful preservative treatment, be made to endure for years, while others still adhere to the opinion that the closer grained pines, being stronger, when seasoned and used in the natural state (without treatment), must necessarily be stronger than the coarser grained timber after treatment; this, however, is a popular fallacy. I do not say that long leaf, the closest grained variety of pine, cannot be treated with preservatives without injury, as I am convinced that it can, but not in a commercial way.

Several years ago I treated several carloads of long leaf heart pine 4 x 10 in. boards with 25.3 lbs. of creosote per cubic foot of timber for Capt. John C. Oakes, who was at that time in charge of the U. S. Army Engineers Corps at Galveston. These boards stood all the tests for strength to which they were subjected; but it was more in the nature of an experiment with me, as it would be practically impossible to expect the care to be exercised which would be necessary to obtain the above results in every case, during the rush of commercial treatments. I contend, and am absolutely convinced, that you can take Loblolly or Bull pine freshly cut (that is, absolutely without seasoning), and subject the same to a comparatively light steaming for several hours and draw out the sap, which is practically all these classes of pine contain. The exact condition of the timber under treatment is indicated to the experienced eye by the flow from the exhaust. If this exhaust is carefully watched it is possible to correctly regulate the temperature and prevent burning; it is also possible to make the "blow off" at the proper instant; then will a light vacuum of comparatively short duration take off the moisture condensed in the cylinder, and assist in drawing the creosote into the cylinder from the operating tank. When the timber has absorbed, naturally, as much creosote as possible after the filling of the cylinder with oil, the pressure pumps if started very gradually will not cause the rush of oil to burst the delicate tissue of the wood cells, and the creosote will penetrate clear to the heart of the timber even with a 12 lb. treatment.



Loading Poles to be Run Into the Treating Cylinders, Galveston Creosoting Co.

Mr. J. H. Hill, general manager of the G. H. & H. Ry., for whom I treated a large number of piling for bridge construction on his line, has advised me that Loblolly pine poles furnished by my company have given as good results as could be desired, and after being several years in use, do not show the slightest signs of deterioration although subjected to the heaviest traffic; and I am advised that it is no longer deemed necessary to slacken the speed of the passenger trains while crossing this bridge resting solely upon Loblolly pine poles, creosoted 12 lbs. per cubic foot. Long leaf pine, containing as it does so much more resin and turpentine, and being the closest grained variety of pine, requires infinitely more preparation before creosote can be injected.

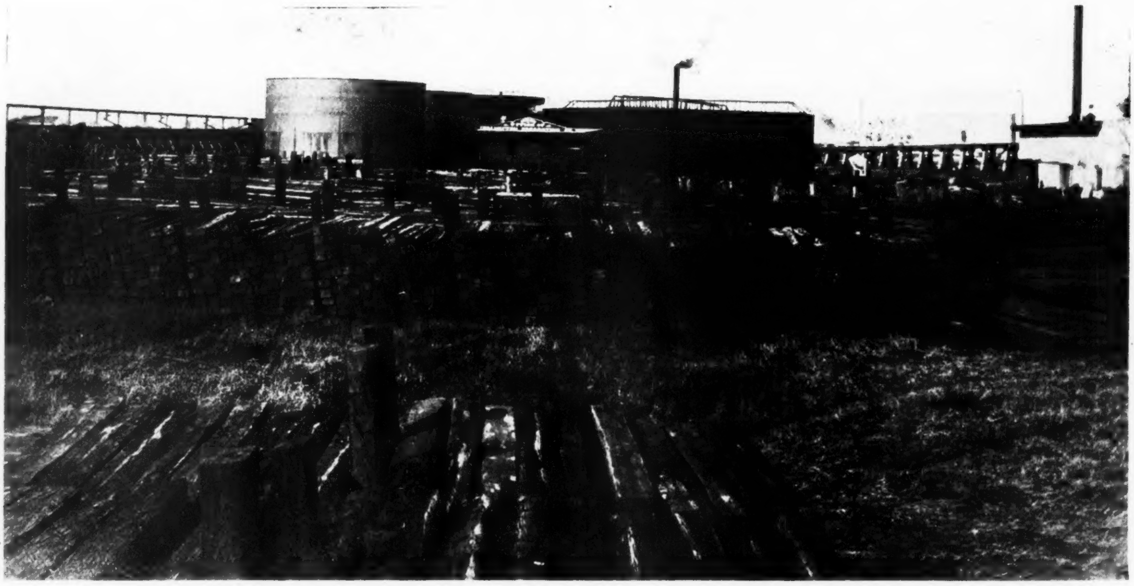
If air seasoning is resorted to the timber will probably check and disintegration take place if the weather is unpropitious before the timber is deemed ready for treatment. The time of the year in which the trees are felled has a very great in-

fluence upon the timber and the time required in which to season the same. If long leaf pine is placed in the cylinder for treatment when freshly cut, it requires infinitely more steaming than the coarser grained varieties, with the result that even when exercising the greatest care it is possible that the timber may be burnt ever so little; this burning will be imperceptable even to an expert, and will be known only by the operator, who has been observing the flow from the exhaust in order to determine the moment the wood was commencing to char, "and he won't tell." You will, therefore, conclude that the closer the fibre of the timber, the more difficult it is to inject the preservative; and whether the wood is air-seasoned or artificially prepared, there is always a risk of it being damaged in either process; and if long leaf pine after treatment has the slightest defect, it becomes infinitely inferior to Loblolly or even Bull pine, although being vastly superior when all are used in their natural state.

A few words in regard to the seasoning of timber would not come amiss. Some experts consider that air-seasoning is preferable to the steaming necessary in artificial preparation, yet D. M. Picton & Co. (who built the jetties at Aransas Pass under contract with the U. S. government and used several hundred of our piling), will tell you that the only piles broken in driving with a 6,000 lb. hammer were those that had been air-seasoned. As an experiment I segregated one cylinder load of piling which was carefully stacked and air-seasoned for approximately 70 days before treatment. These piles were carefully inspected by the U. S. Army Engineers' inspector, who reported that the piles were sound and good. When placed in the treating cylinder live steam at not to exceed 30 lbs. pressure was turned on for half an hour, when a vacuum of 20 inches was drawn for a like period, and I had no difficulty injecting the required amount of creosote, viz.: 24 lbs. per cubic foot under pressure of less than 70 lbs.; yet of these piling quite a number broke in the process of driving. Of the freshly cut piling, artificially seasoned, not one was broken; this test to my mind proves conclusively that the best results are obtained from Loblolly pine piles treated as soon after the trees are cut as possible. The above remarks apply to poles also, which need not in my estimation receive more than 10 lbs. treatment of creosote per cubic foot, for the reason that if a thorough penetration of oil is obtained the creosote will naturally gravitate to the base of the pole when standing in a vertical position; in other words the creosote will naturally follow the course of the wood cells, which run longitudinally of the pole, and as rot begins at the ground line, the creosote will naturally concentrate where it is most needed.

Relative to the various kinds of treatment of which there are any number, it is interesting to note that when the best results are desired the old "Bethel" or "Full-Cell" process is applied, and in many cases the cheaper solutions adopted as substitutes for creosote have been abandoned even by their inventors; and it may safely be said that the most modern plants today use only creosote treatments. This brings about a rivalry which tends to develop cupidity and as most of the consumers of the products of timber-preserving plants have not studied the subject, and apparently are unable to discriminate between good and inferior treatments, there is a great incentive on the part of manufacturers to cut their prices, in some cases which have come under my observation, even below the cost of production. This method has only one result, viz.: the product must suffer, and as long as price counts with the consumer more than the class of work turned out just so long will unscrupulous manufacturers resort to means of reducing the cost of production regardless of the effect on the lasting qualities of the timber after treatment. Some manufacturers will consider themselves quite virtuous while placing from two to three feet of water on top of their creosote to prevent evaporation; and the U. S. Army Engineers' Corps found in samples taken from the tanks of one concern that the creosote contained over 21 per cent of water, yet the average consumer will place his orders with such a plant if the price quoted happens to be 50 cents per thousand feet B. M. less than another who covers his tanks with metal tops, thereby preventing even rain water from entering and weakening the efficacy of his oil. I lose in the course of a year a large percentage of creosote from volatilization, yet my oil is received directly from tank-steamers by pipe line into my storage tanks and is carefully guarded until placed in the operating cylinder, without additions or subtractions, yet it would be a stupendous undertaking to endeavor to convince a prospective purchaser that my product was worth more than the price quoted by a competitor who intended using an infinitely inferior grade of creosote. Unfortunately, creosoted material all

Wharf Facilities for Exporting Treated Woods.



Tie Storage Yard, Galveston Creosoting Co.

looks alike; in fact, the timber which has received the best penetration looks lighter on the outside than that which has the oil forced into it at so high a pressure as to explode the wood cells, and in which the creosote is only on the outside or penetrates for a quarter of an inch at most.

In conclusion I might state that the best results are obtained from creosoted timber, after careful treatment with pure oil, by carefully stacking the treated timber in such a manner as to rest horizontally; thereby allowing the lighter oils to volatilize, the heavier oils to coagulate, and the naphthalene fractions to crystalize. In this manner the softest pine will in time become so hard as to make it almost impossible to cut with an ordinary pocket knife with which you would have no difficulty in slicing strips from the closest grained untreated timber. If consumers would place their orders well in advance of their requirements, they would be able to benefit by the above condition; but the usual purchaser asks how soon delivery can be effected before even considering the price, and the class of product generally comes as an afterthought. If creosoted ties are placed in dry ground immediately after treatment the oil will be drawn through the ties into the soil, and then washed away by the first rain; whereas if the ties are carefully stacked for 60 or 90 days after treatment the creosote will remain in the timber. The same condition will apply to creosoted poles and piling; if they are at once placed in a vertical position the liquid oil will immediately gravitate to the bottom of the stick; whereas if these timbers are placed on skids horizontally and the solidification of the creosote constituents allowed to take place, enough of the oil will remain in the body of the poles to preserve them from rot. And while the creosote will in any case eventually gravitate to the base of the poles when placed perpendicularly in the ground, the process will be much slower.

When high voltage is to be carried on creosoted poles it is best to place the poles in position for use immediately after treatment, thus allowing the creosote to accumulate at the base and overcoming the objection advanced by many that a creosoted pole will conduct the current, to the discomfiture of the linemen who have to climb them.

To provide additional facilities for handling traffic on its Indianapolis division, the Pennsylvania is constructing 25.9 miles of second track. The work involves the elimination of twenty-five street and highway and two railroad grade crossings. This will cause the building of four overhead and sixteen undergrade crossings and the vacation of five highways. The Indianapolis division, extending from Columbus, O., to Indianapolis, Ind., carries the heavy through freight and passenger business of the Pennsylvania between points on the eastern lines and Indianapolis and St. Louis. Heretofore the Indianapolis division from Richmond to Indianapolis, some 68 miles, was single track, with the exception of six and one-half miles of double track in terminal yards. The double tracking authorized is in two sections, 17.6 miles from Richmond to Dublin and 8.3 miles from Dunreitk to Knightstown. In connection with the double track work, it was decided to reduce the maximum grade from 1.1 per cent to .7 per cent, or about 35 feet to the mile. This necessitates changing the grade on 21.3 miles of line, but when completed it will enable the company to operate much heavier trains over this division with the same locomotives now in use, thereby increasing the efficiency of operation. A change of line of about a mile is being made just east of Knightstown. It will replace a 3 deg., 50 min. reverse curve and a 1 deg., 32 min. curve by a single 1 deg. curve, saving some 121 degs. of curvature and 880 feet in distance. At other points where the change in grade is considerable, an entirely new double track road bed is being built, and when this is completed the old line will be abandoned. The double track road is to be elevated through Cambridge City, Raysville and Knightstown, and depressed through Dublin. All masonry in this work is of plain or reinforced concrete. There have been built nineteen concrete arch bridges, thirteen steel trough floor bridges, and three plate girder bridges. The three largest bridges each have three spans of 60-foot arches over streams at Centreville, Cambridge City and Knightstown; each of these bridges contains about 5,000 cubic yards of concrete. In making this improvement 1,850,000 cubic yards of earth have been graded and 71,000 cubic yards of concrete masonry used. For eight miles west of Richmond the new tracks are practically completed and in operation, and it is expected that the entire improvement to the Indianapolis division, costing some $2,750,000, or a little more than $106,000 per mile of line, will be completed during 1911.

Specifications for "A" Grade Vitrified Clay Conduit

The following is taken from data compiled by the Clay Product Co.:

The quality of the materials used and the methods of manufacture, handling and shipment of clay conduit shall be such as to insure for the finished conduit the properties and finish called for in these specifications. The manufacturer must make sure that all material and work are in accordance with the specifications before the conduit is delivered. The inspector for the purchaser shall have the power to inspect and reject any material or conduit before loading which fails to satisfy the requirements of these specifications, but such inspection by the customer at the factory shall be final.

General.

Conduits furnished under these specifications shall be single-duct or two, three, four or six multiple duct, as specified by the purchaser.

Material.

All conduits shall be made of finely ground, compact clay, thoroughly vitrified, and shall be free from stones and pebbles. The conduits shall be uniform in size and quality.

The inspector for the purchaser shall be allowed to test for absorption the average run of conduits offered for shipment by completely immersing a number of average samples for twenty-four hours in water at a temperature of from sixty to eighty degrees Fahrenheit.

Conduits showing an average absorption not over 5 per cent to be accepted for shipment.

Dimensions.

The length of all conduits, unless otherwise specified by the purchaser, shall be as follows:

Single-duct	eighteen inches
Two-duct multiple	twenty-four inches
Three-duct multiple	twenty-four inches
Four-duct multiple	thirty-six inches
Six-duct multiple	thirty-six inches

Short lengths shall be furnished when called for; the number of pieces, however, shall not exceed 1 per cent of the total number of duct feet ordered. All pieces less than one foot long shall be paid for at the price of one foot.

All duct holes shall be at least three and one-quarter inches in diameter, unless otherwise specified. Measurements of square duct shall be between parallel surfaces.

The walls of all single conduits shall not be less than seven-sixteenths of an inch thick at their thinnest part.

The outer walls of all multiple conduits shall not be less than five-eighths (5/8) of an inch thick at any part, and the inner walls or web shall not be less than seven-sixteenths of an inch thick at their thinnest part.

Shape and Finish.

All conduits shall be reasonably symmetrical both on the outside and in the duct hole.

The ends of all conduits shall be perpendicular to the sides. All duct holes shall be beveled at the ends. All ends shall be practically smooth and free from projections. The interior corners of all duct holes and the exterior edges of the conduit (except the ends) shall be slightly rounded.

Alignment.

The duct holes for single conduits shall be well centered. No conduit shall be twisted nor bent in more than one direction nor bent in one direction on edge. A straight-edge laid lengthwise on the concave side of the conduit three feet in length shall not show an offset greater than three-eighths of an inch, allowance being made for the scarification ridges at the ends. The allowable bow in short lengths shall be proportionate to the limit specified for three-foot lengths.

Cracks.

Cracks in the walls or web of multiple conduit shall not have an opening greater than one-sixteenth of an inch nor be over two inches long. Cracks at the end of a single conduit shall be not over one-half inch long.

Blisters.

Single and multiple conduits with round holes shall be free from unbroken blisters or other projections on the interior walls. Unbroken blisters or other projections on the outer walls of multiple or single conduits shall not be of greater thickness than one-eighth of an inch. The interior walls of conduits with square holes shall be free from unbroken blisters or other projections except in the corners. Unbroken blisters or other projections in the corners of the interior walls of conduits with square holes shall not be more than one-eighth of an inch in thickness, and shall not extend out on the inner wall from the corner so that there shall be less than two and one-half inches of surface without projections on all interior walls.

Recesses in the walls of single and multiple conduits caused by broken blisters or other defects in the process of manufacture shall not decrease the thickness of the walls more than three-sixteenths of an inch. When on the interior walls the edges of the defects shall be smoothed so as to offer no projecting edges.

Scarifications.

The outer walls of the multiple conduits shall be scarified or otherwise suitably roughened for at least two inches at each end.

The outer walls of single conduits shall be combed with two sets of three combings each, running lengthwise on the conduit (and placed adjacent to the corners).

Glazing.

At least 75 per cent of all conduits shall be thoroughly glazed. All conduits not thoroughly glazed on the inside shall be smooth, thoroughly vitrified and shall meet the absorption requirements as before specified.

Dowel-Pin Holes.

Unless otherwise specified, all multiple conduits shall be provided with at least two dowel-pin holes. Dowel-pin holes shall be not more than fifteen-thirty-seconds of an inch nor less than eleven-thirty-seconds of an inch in diameter, and shall be located in the center of the intersection of the partition walls, and, when necessary, in the center of the intersections of the partition walls with the outside walls.

Dowel Pins.

Dowel pins shall of a good grade of wrought or cast iron and shall be not less than three and one-quarter inches long. Means shall be provided that will prevent the pins from slipping entirely into the dowel-pin holes of either section.

Estimated Cost of Construction.

The following specifications and estimates are not based upon theory, but upon data obtained from a great many sources, under many and varying conditions, by expert engineers of long experience, as well as by conscientious workmen who have had very little previous experience in conduit construction. "Unit Costs" are derived by averaging the items from all the data, then adding 10 per cent. All of these costs should be lowered by careful buying and by proper supervision. The union wage scale is used for figuring the labor costs. To these construction costs should be added the delivered price of the conduit. This quotation will be furnished upon application.

Specifications and Costs With Concrete Envelope.

trench should be six inches wider than the conduit, to allow

for the laying of the concrete envelope without a form. The concrete envelope should be three inches thick, entirely surrounding the conduit. The three-inch bed should be placed level with the drainage slope in the bottom of the trench and the conduit laid on top of the wet bed. Sufficient number of dowel pins should be used to properly line the conduit. Strips of burlap or heavy muslin four inches wide and three feet long should be laid over the joining of the conduit pieces. The concrete should then be tamped down between the sides of the conduit and the walls of the trench, and a three-inch cover of concrete spread over the conduit. Where the conduits are built up to make a run of more than one piece in the trench one-half inch of mortar should be spread between the conduits. This is most economically done by sweeping with a coarse fibre push-broom. The concrete mixture should be made in the proportion of 1, 3, 5.

The conduit line should be made up as follows:

1 duct —1 square or round-duct single conduit.

2 ducts—1 piece 2-way conduit.

3 ducts—1 piece triangle 3-way conduit.

4 ducts—1 piece 4-way conduit.

5 ducts—1 piece 2-way conduit below and one-piece 3-way conduit above.

6 ducts—1 piece 6-way conduit .

8 ducts—2 pieces 4-way conduit.

Cost Units.

Excavation and refilling without repaving, should cost less than $.70 a cubic yard, or $.026 per cubic foot. Hauling away extra soil should not cost more than $.50 a cubic yard, or slightly less than $.019 a cubic foot.

Concrete costs are based on the following:

1 cubic yard of concrete will cost (mixture 1-3-5), Cement at $1.70 bbl. (4 cubic feet).

5 cubic feet	$2.125
Stone or gravel, 1 yard	1.65
Screenings or sand 16.2 feet at $1.40 yard	.84
	$4.615

Laying concrete with conduit into the trench, including the wages of union bricklayers. To lay the conduit should cost less than the following per cubic yard of concrete, including the cost of joints:

Single duct	$1.50	plus material—$6.115 or	$.226 cubic feet.
Two-way	1.45	plus material— 6.065 or	.224 cubic feet.
Triangle three-way	1.325	plus material— 5.940 or	.220 cubic feet.
Four-way	1.35	plus material— 5.965 or	.221 cubic feet.
Six-way	1.30	plus material— 5.915 or	.219 cubic feet.

Specifications and Costs Without Concrete Envelope.

These specifications provide for the laying of conduit in runs, without a complete concrete envelope, but a strong and tight mortar joint joining the adjacent pieces. The concrete envelope does little more than protect the conduit line from foreign picks in later trench construction. In cities of 25,000 or less or along railroad signal lines this type of construction is very strongly recommended. The same recommendation may be made for larger cities in outlying conduit runs or wherever the conduit is laid in alleys or other places not apt to be severely dug into in the future.

The trench should be dug deep enough to allow the top edge of the conduit to be at least two feet below the top surface. The conduit should be laid to drain from manhole to manhole or from the center of the run to each manhole. The trench should be dug wide enough to allow sufficient room for the conduit layers to work. Usually 5 inches wider than the conduit, is sufficient, but these costs figure the width as 6 inches wider than the conduit.

The bottom of the ditch should be carefully leveled with a square-edged shovel. Three or four trowels of mortar are put in the trench where the joint is to come; the perforated metal wrapper is then clinched tightly about the joint. The mortar is spread over the top of the wrapper to the thickness of about two inches and allowed to thin out on both sides, making the joint about eight inches wide. Mortar is then troweled down on the sides of the joint or a U-shaped metal form may be inserted at the sides of the joint, filled, and the form removed.

In some cases it is found advisable to reinforce this construction by first putting in a two-inch bed of concrete in the bottom of the trench to guard against washouts, etc.

Cost Units.

The costs of excavation, refilling and disposal of extra soil are the same as those given for construction with the concrete envelope.

Cement Joints—One joint for each piece.

Mortar mixed, 2 parts Cement and 3 parts Sharp Sand. Cost per cubic yard.

Cement	$3.05
Sand	1.15
Total for Materials, per cubic yard	$4.20

or $0.155 per cubic foot.

In the following table the cost of each joint is figured with the cost of laying each piece of conduit, so that the cost of the joint must be distributed for the whole piece, as follows:

	2 ducts	3 ducts	4 ducts	6 ducts	8 ducts
Material	.0573	.0532	.0713	.08292	.10137
Metal Wrapper	.0160	.0160	.0190	.02200	.03800
Labor, Mixing and Laying	.0666	.0655	.0690	.06710	.12700
Cost of Joint	.1399	.1347	.1593	.17202	.26637
Cost per 1 Trench Foot	.0699	.0449	.0531	.02867	.03329

Costs Per Trench and Duct Foot.

	2 ducts	3 ducts	4 ducts	6 ducts	8 ducts
Excavating and Refilling	.07540	.08801	.08944	.10036	.11362
Disposal of Extra Soil	.00551	.00475	.01064	.01539	.02147
Cost of Joint and Laying Conduit	.06990	.04490	.05310	.02867	.03329
Total Cost per Trench Foot Without Bed	.15081	.13766	.17318	.14442	.16838
Total Cost per Duct Foot Without Bed	.07540	.04588	.04329	.02407	.02105
Cost of Concrete Bed 2" Thick	.02682	.02682	.02682	.02682	.02682
Cost per Trench Foot with Bed	.17763	.16448	.20000	.17124	.18943
Cost per Duct Foot with Bed	.08881	.05482	.05000	.02854	.02368

Manholes.

Manholes for telephone work should be made large enough to accommodate future growth, and where the streets are sufficiently clear to allow, the manholes should be not less than 6x4 feet. An oval manhole with its broadest dimension 6 feet, made of sewer brick with cast-iron cover and concrete floor with a sewer drain, should not cost more than $75.00. Where it is possible to make uniform manholes, so that the same forms may be used throughout, the concrete manhole is by far the most economical construction. With the tops reinforced with cross-bars of iron and woven wire and with the usual iron cover, the cost may be as low as $37.00, exclusive of cost of the forms.

Eating House at Booneville

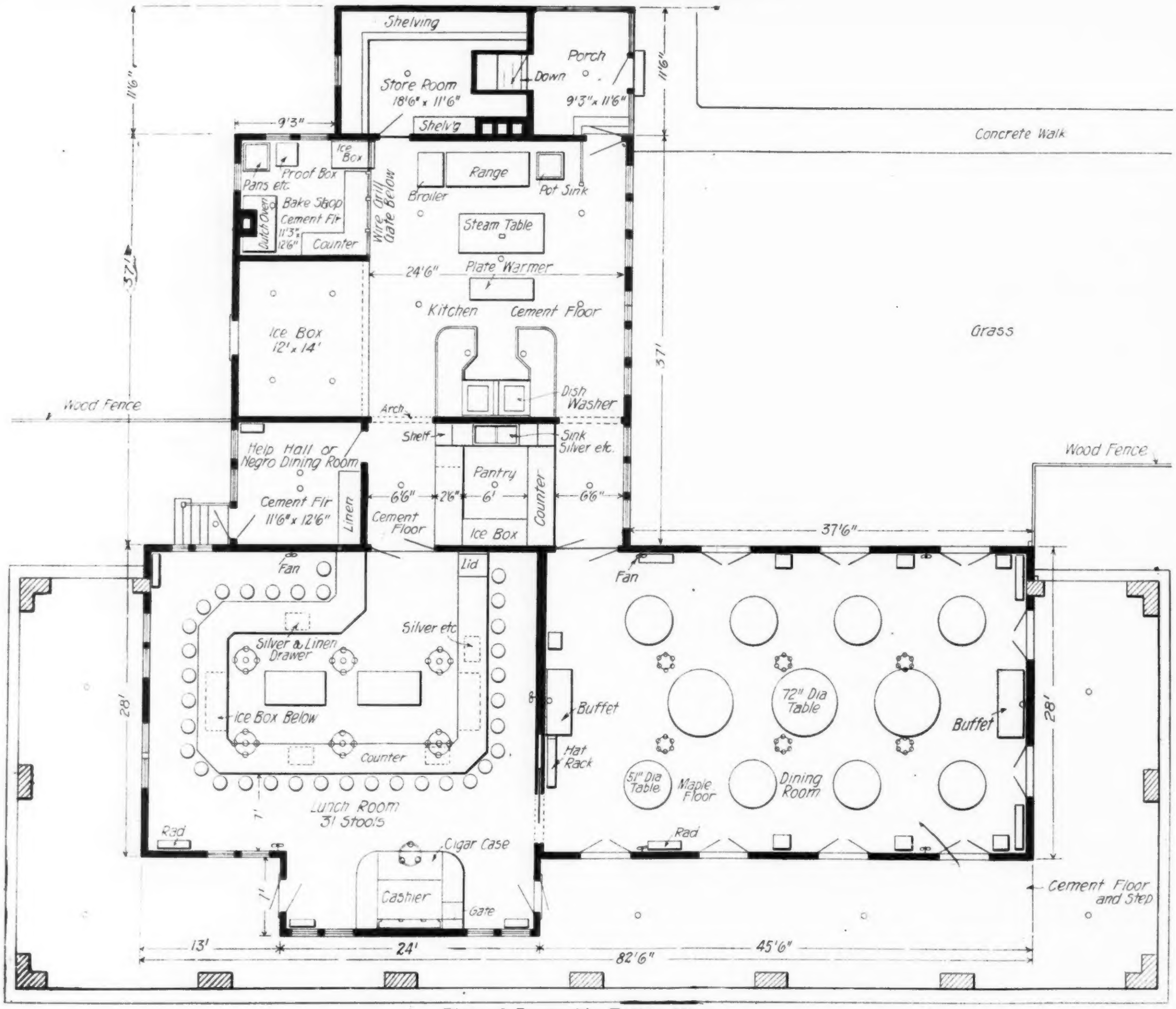
One of the things which makes traveling a pleasure and which leaves a good impression of the road traveled over, is a clean and efficient dining service. Under the supervision of J. J. Grier the eating houses and hotels of the Rock Island lines have reached a high state of excellence, of which the new eating house at Booneville, Ia., is the crowning example. This eating house, as shown in the illustrations, is built in the form of an "L." The building is covered with rough stucco and is surrounded on three sides by a wide porch which is supported by columns constructed of granite boulders. These porch pillars contribute much to exterior appearance of the building. The roof is covered with red tile made at Coffeyville, Kan., and the porch floors are of cement.

Eating House at Booneville, Rock Island Lines.

The building is divided into three main divisions, the kitchen, lunch room and dining room. The latter two occupy the main portion of the building and the general design of the two is the same. The ceiling of the dining room is elliptical, which allows the placing of a large oil painting clear across each end. The side walls of both rooms are divided off into blocks of approximately 12x24 inches and are finished to represent French caen stone. The windows of the dining room are the long French windows and these, as well as the sliding doors between the two rooms, are divided into small panes. The painting and decorating was done by W. P. Nelson Co. of Chicago. All the dining room furniture, including the table, chairs and sideboards, are made of Arkansas gum wood, which was obtained from the forests near Booneville and made up at Grand Rapids, Mich. The electric light fixtures were designed by J. H. Dimery of Chicago and are very artistic, as the photographic reproductions show. The floors of both dining and lunch rooms are of varnished white maple. The lunch room is of the usual arrangement; the counter with its seats forming a three-sided inclosure containing cashier's desk, coffee, water and milk urns, and the display cases. The lunch room is finished with dark oak panels, but inside the inclosure and under the counter everything is finished with white enamel, making it easier to keep things clean. The urns are heated with steam and underneath the counter is a good sized ice box containing shallow trays for holding individual butter cubes; also compartments for meat, cracked ice and mineral water.

As much care and thought has been put in on the kitchen as on the dining rooms and the main objects have been cleanliness and convenience. The heart of the kitchen—the range and broiler—are at one side of the room and adjacent to them is the steam table used to keep the various edibles

Dining Room, Booneville Eating House.



Plan of Booneville Eating House.

warm. Another steam chest is used to keep the china warm until it is needed for service in the dining room. On a rack near the range is a complete assortment of aluminum pots and kettles. A big mechanical dish washer is installed and a store-room at one side is well stocked with everything which the patrons might desire. The large ice box for the kitchen was made by the Northey Mfg. Co. of Waterloo, Ia., and is divided up into various compartments for fish, milk, etc. The kitchen floor is of cement, and as all the equipment is raised above the floor on legs, it is an easy matter to flush out the floor with the hose. Booneville is a division point and due to the arrangement of the train schedules, the dining room does the biggest business during the morning and evening meals, while the lunch room is the popular place at noon.

USE OF DIAGRAMS FOR SOLVING ENGINEERING FORMULA.

(Continued from page 67, February issue.)

By Gordon F. Dodge, M. W. S. E.

CENTRIFUGAL FORCE.

In the case of formulæ like that for centrifugal force, $C = wv^2/gr$, in which,

C = centrifugal force,

w = weight of moving body in pounds,

v = velocity of center of gravity of weight in feet per second,

g = acceleration of gravity,

r = radius in feet of the path of center of gravity of weight,

there enters a quantity v^2, which is, in the most common use of the formula, a product of other elements, and a separate calculation becomes necessary to determine its value from the quantities of which it is the product. As these quantities are those usually met with in calculations of centrifugal force, it is entirely feasible to incorporate into the diagram the solution for this quantity v as determined by its formula.

$$v = 2\pi r \text{ r. p. m.} \div 60 = 0.1047\, r \text{ r. p. m.}$$

As this expression is a simple product, the results of various combinations will be 45 deg. lines, and it will be necessary to use but one value of r, as say 10 ft., in connection with each assumed r. p. m., in order to obtain the information with which to plot the first series of lines in Fig. 6, using r as abscissas and v as ordinates.

In the second step of the solution the equation is transformed into,

$$C/w = v^2/gr,$$

the first part of the equation being considered as one variable and a table of values calculated for a constant value of v and a series of values of r. As g is a constant quantity, it will have the effect only of making a constant variation in the values of C/w and will not affect the slope or curvature of the lines. It may therefore be included directly in the process of division. The quantity v enters the expression in the second degree, and as it is used as an ordinate, the slope

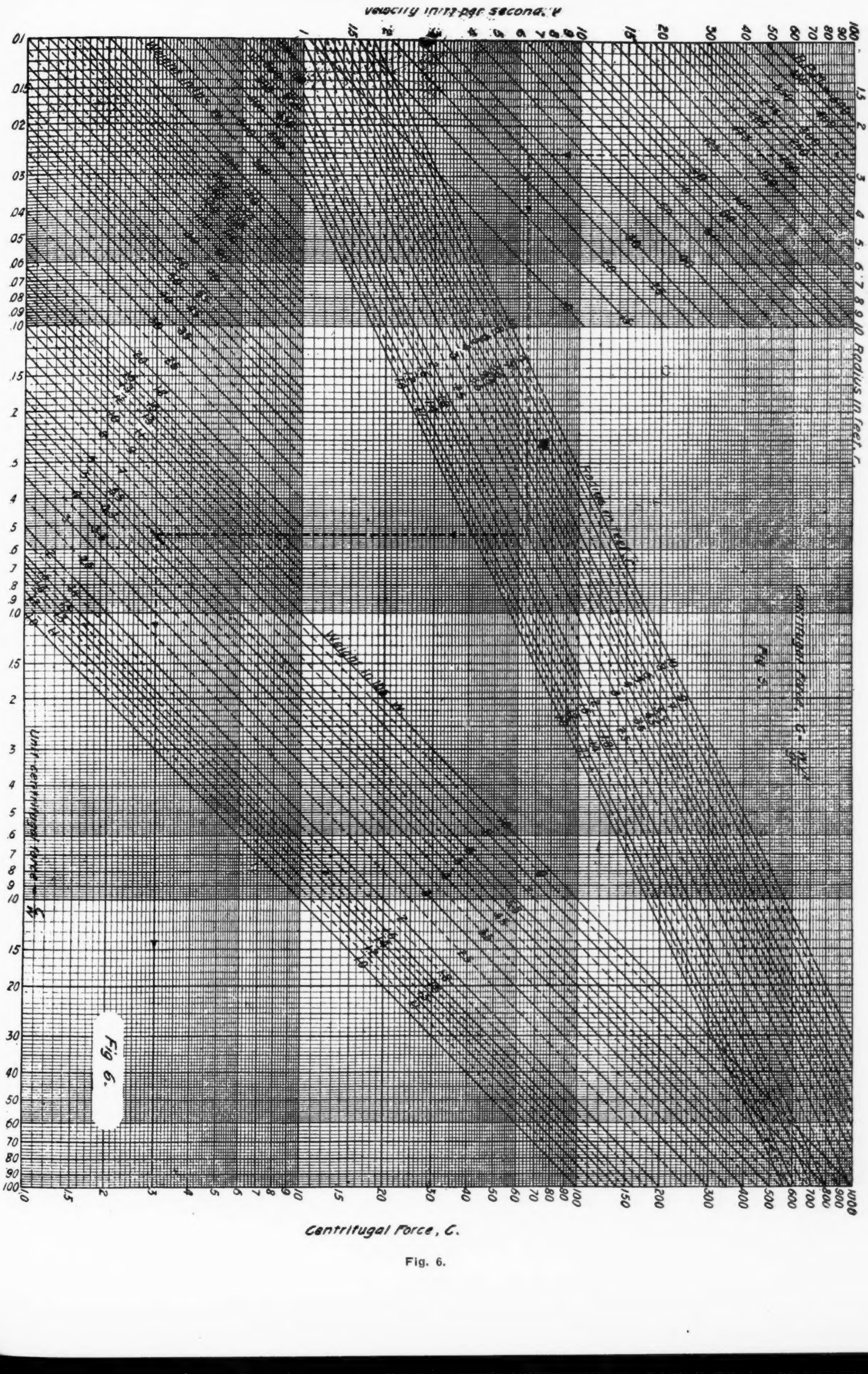


Fig. 6.

of the series of *r* lines will, as previously stated, be such that they will make an angle with the vertical axis, the tangent of which is two (2), the index of the power of the ordinate. In other words, the *r* lines will rise vertically from $v = 10$ to $v = 100$ while reaching horizontally from $C/w = 1$ to 100. With the slope known, only one point on each *r* line need be calculated.

With C/w determined, and the *r* lines plotted with these values for abscissas and v as ordinates coinciding with the v scale of the preceding set of lines, the final step will consist of calculating a table of values of C from some constant value of C/w, by multiplying by a series of values of w. diagram being simple multiplication, the w lines will be straight, 45 deg inclined upwards to the right. On account of the wide range, the series of w lines having values of from 1 to 10 would extend far beyond the vertical limits of the paper in covering all the values of C/w (unit centrifugal force). To overcome this difficulty and remain within the limits of the paper, the values of w are increased up to 1,000 in the lower portion of the diagram. The same principle of final results applies to these lines, as was stated before, viz., the multiplication of the marginal result by the quotient of the actual weight divided by the value of the weight line. In the solution indicated by the heavy dotted

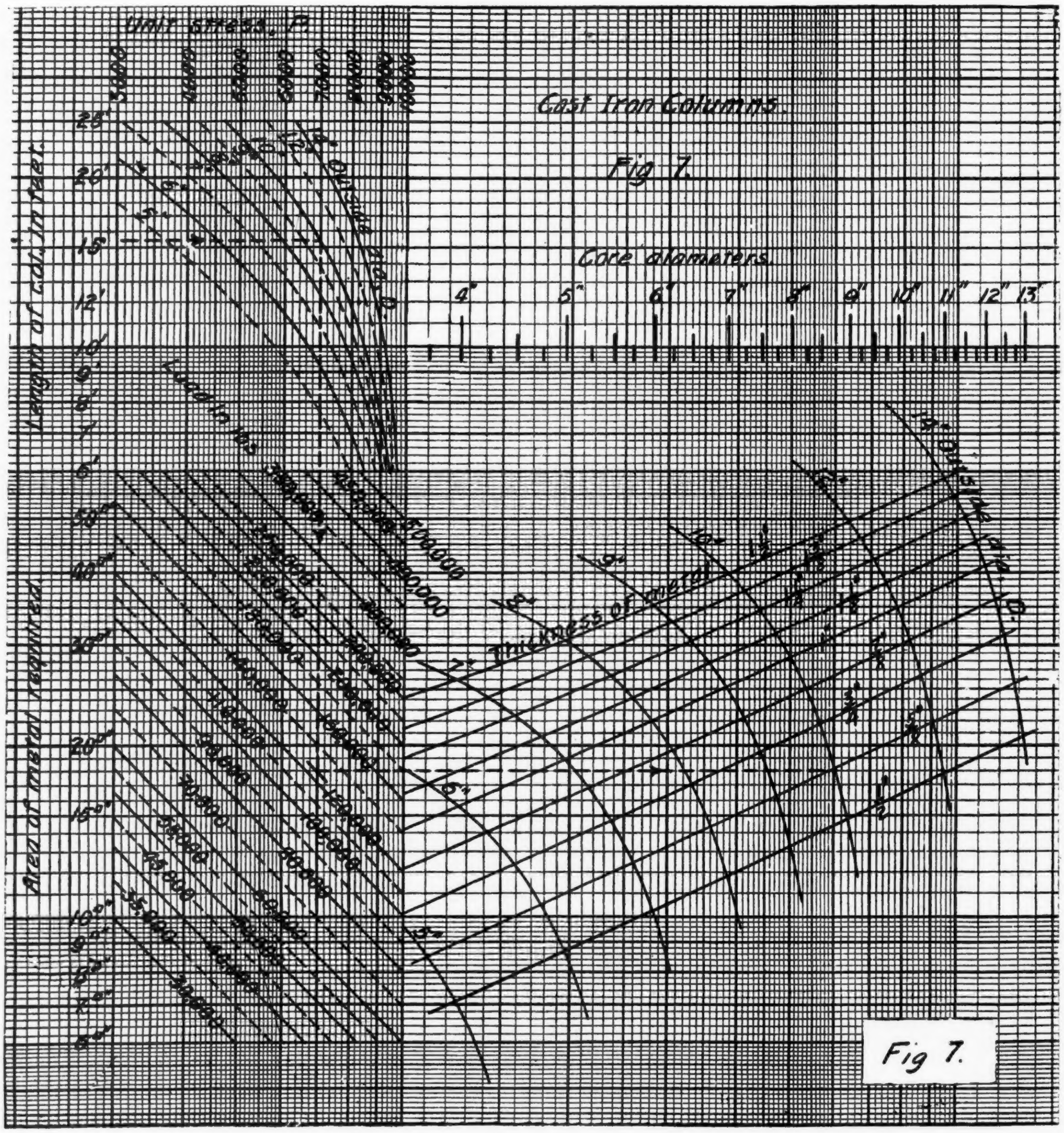


Fig 7.

Obviously, values of w from 1 to 10 might be used, and the results plotted for this range only. In any particular solution then, it becomes necessary to multiply the final result as given by the diagram by the quotient found by dividing the actual weight by the value of the weight line used. That is, if the weight were 600, and the weight line used be 6, the result would be multiplied by 100.

The calculations involved in plotting the third step of this meander line, a weight of 560 lb. is rotating at a speed of 25 r. p. m. on a radius of 2 ft. 6 in. In this problem the abscissa of C/w (unit centrifugal force) intersects a w line having a value of 5.6, and the marginal result given by the diagram will therefore have to be multiplied by 100, giving a final value of 300.

In any problem where the velocity is known directly and not as the elements of which it is a product, this known

value of v may be used as the entering point, and the solution found exactly as though the first step had not been omitted.

With radii 10 or 100 times as great as those given on the diagram, the result as obtained in the usual manner will be multiplied by 10 or 100 respectively if the solution starts with r and r. p. m., while it will have to be divided by the same numbers if it starts with velocity directly.

CYLINDRICAL CAST IRON COLUMNS.

A diagram for the complete determination of the column necessary to carry any specified load is given in Fig. 7. The basis of this diagram is Gordon's formula,

$$P = 80{,}000/(1 + (12L)^2/800D^2),\ \text{in which,}$$

P = the ultimate unit load for square ended columns,

L = length in feet,

D = outside diameter in inches,

80,000 being the ultimate unit compressive strength assumed for cast iron.

Since this formula contains but three variables, a simple diagram with one set of curves will suffice to plot all variations of unit-strength. This is done in the first set of curves of Fig. 7, with diameters from 5 to 14 in., and plotted with lengths as ordinates and unit-strengths as abscissas. In these curves, however, a working strength of one-eighth of the ultimate was used, giving therefore, the working unit-strength instead of the ultimate.

Having the unit-strength, the diagram may be extended another step so as to solve for the area of metal, necessary to carry a given load by simply dividing the loads by the unit-strength, represented by the expression, Area = Load/P.

This relation is plotted in the second set of lines on the diagram with the same P scale as the first set and with areas as ordinates.

It is possible now still further to extend the diagram so that the required area, combined with the knowledge of the diameter used at the start, will give the inside or core diameter. This result is obtained in the third set of lines, where each D curve is plotted by assuming the abscissas to represent the core areas of the columns and points on the curves

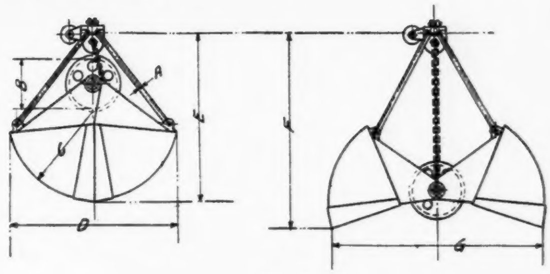


Fig. 8.

located, by plotting the relationship expressed by area of core = area of D — area of metal.

To enable the reading of core diameters, it becomes necessary then, that the points representing the areas of circles of various sizes be pointed off and marked on the axis of abscissas representing these core areas, when the diagram will become available for finding directly the outside and inside diameter of a column necessary to carry a given load.

To show a further possibility, another set of curves has been plotted crossing the last or second set of D curves. This gives the final dimension of design as the thickness of metal required instead of the core diameter, and is obtained by pointing off the intersections of the D curves with the abscissa representing a core area that would result with the given thickness of metal, and then connecting all points representing that thickness with a curve for that value of t.

The heavy dotted meander line indicates the solution for a column 15 ft. 6 in. long to carry a load of 125,000 lb. The diameter of column to be used may be limited in many ways, and often is determined by the limitations of the foundry in securing a sound casting. The solution as indicated assumes a diameter of 10 in., and shows a thickness of ⅝ in., of metal required. It is, of course, necessary that in any solution the same set of D curves be used in the last step as was used in the first step.

While this last diagram is plotted to solve for the strength of columns under a working stress of 10,000 lb. per sq. in.,

Fig. 9.

it could have been made universal in its application by the simple expedient of adding one step between the first and second as plotted, thus permitting the use of any stress desired. Thus, while the commonly used formula gives as results only the permissible load per square inch of metal, it is seen how easily additional steps may be added to make the completed diagram cover all applications of the original formula to problems commonly met in engineering work, and once the diagram has been constructed the solution of any problem is but the work of a few seconds.

In Figs. 8 and 9 is shown the application of diagrams to another type of solutions,—that of simple proportions as involved in the design of a line of machinery of a given type. The usual method in such a case is to build and perfect one size and then proportion others from this.

Two views of what is commonly known as a clam-shell bucket are shown in Fig. 8. With this class of machinery the rating is generally given in terms of cubic yards capacity, and it is evident that an equation for any linear dimension in terms of the rating will involve the cube foot of the capacity of the given size.

Assuming that the three-fourths yard size has been built experimentally and perfected, the problem becomes one of securing rational variations in proportions for other sizes. By referring to Fig. 9 the method used will be seen. Here the ordinate used is the rating in cubic yards, and the ascissas are the linear dimensions in inches. With all dimensions of the three-fourths yard size known, the horizontal locations of these points are plotted on the three-fourths yard ordinate.

Now, as explained at the beginning of this paper, a line representing an expression in which the ordinate is involved to any degree as the one-third, or cube root, will make an angle with the axis of ordinates, the tangent of which will be the exponent of the power or one-third. Take any dimension then, as E, the height closed, and draw a line through the plotted point, making an angle with the vertical, the tangent of which is one-third, and this line will then give, by its intersections, the lengths of all other sizes. Lines parallel to the first one drawn through the other points plotted, give, in a similar manner, the dimensions of other parts, and although only a few are shown here, it is evident that the principle can be extended indefinitely to cover practically all linear dimensions.

The weight of such a machine should rationally vary about as the capacity. For the heaviest materials to be handled this proves true, and the 45 deg. line marked *Weight Heavy* would indicate the variations on this basis. For lighter material it is possible to reduce the weight per unit of capacity in the larger sizes, and this is shown by the line marked *Weight Light*. The reason for the break in direction of the weight lines for small sizes is that when a certain size is reached the minimum sections are used, and below this the reduction in weight is small.

Desplaines Valley Railway

The Chicago & North-Western Railway is at present showing activity on three large construction jobs in and near Chicago. A review of its work for several years would seem to show that these and other recent construction jobs are parts of a comprehensive terminal plan, a plan the main features of which were doubtless worked out years in advance of the construction.

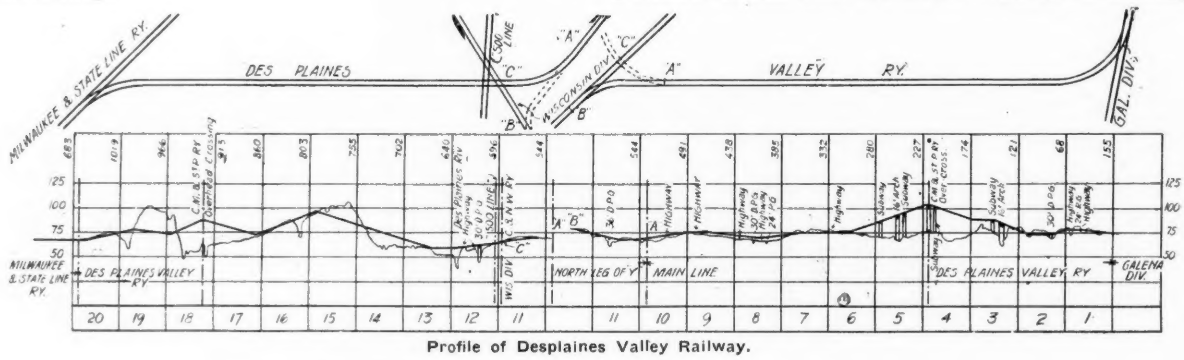
Track elevation of main lines is compulsory in the city limits, and still none of the old main lines within a mile of the depot were elevated, and permanent run offs have been made. Reason for this is now seen in the magnificent new passenger terminal with tracks laid on entirely new right-of-way, and providing for the practical abandonment of the old tracks at city grade, for passenger traffic. The new tracks afford much larger facilities than could have been obtained on the old right-of-way. The location of the new tracks and terminal will do away with a Chicago River bridge and with the delays so common on account of the bridge being opened to allow the passage of river boats.

It is thus seen that the Wells Street bridge recently erected was really a temporary construction to tide the railway over until the new terminal would be completed; probably this is the reason that only a two-track bridge was erected, where the traffic demands would certainly seem to require a four-track bridge.

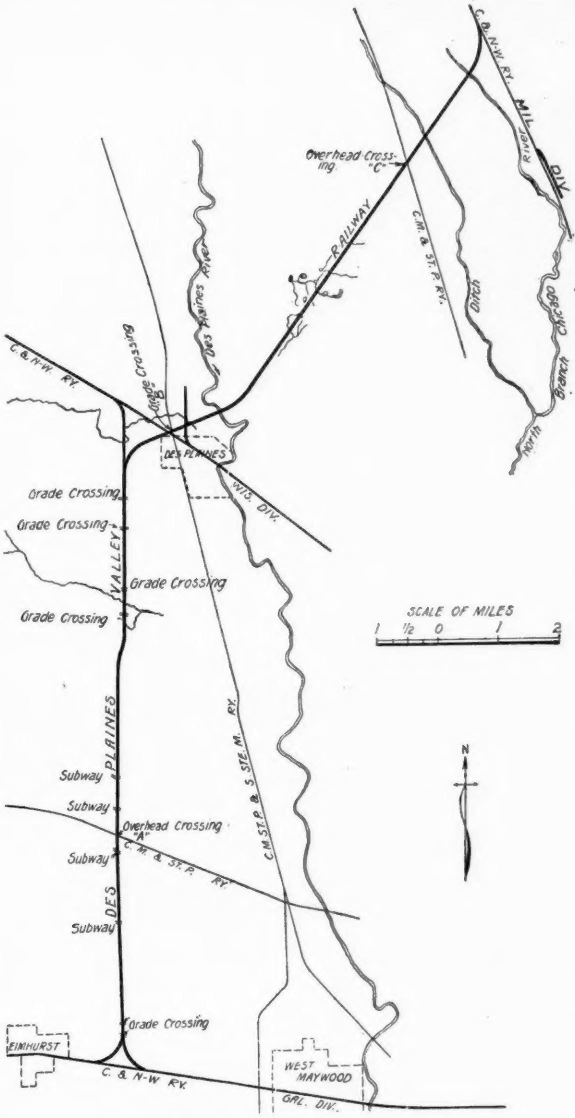
The addition of an annex for suburban traffic, which was made to the Wells Street station several years ago, was also a temporary construction, made to accommodate only the immediate needs of traffic. The track layout, the interlocking plants and, in fact, the whole equipment of this station has not been kept up to modern high standards, and congestion has some times been the result. These conditions would only be allowed to exist in temporary construction, or structures soon to be partially or wholly abandoned.

Formerly the company had their Galena Division passenger coach yard at Ada Street, extending westward, and south of the main lines. In 1903 a new and modern coach yard was constructed at Western Avenue. The old coach yard, which would doubtless have soon been too small, was disposed of. The location of the new terminal tracks at Ada Street is north of the old main lines, and comes into them at Noble Street. With this new layout a back-up movement would have been necessary to get into the old Ada Street yard. A run into the Western Avenue coach yard is made without back-up movements, from either the old or the new track layout.

In the spring of 1906 work was started on third and fourth tracks between Melrose Park and Elmhurst, and later on in the summer a large yard was constructed at Proviso, which is situated between those two towns. Trackage for handling



Profile of Desplaines Valley Railway.



Territory Map, Desplaines Valley Railway.

Desplaines River.

a large freight business was installed, much larger than the amount of business done there since that time would seem to warrant. From this latter fact we conclude that a large increase of freight traffic was to be expected from a new source. At the present time additions are being made to the Proviso yards and the plans include a new roundhouse and machine shops.

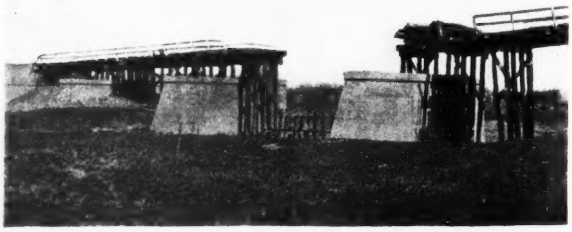
The reason for the extensive construction at Proviso has been partially made clear by the construction of the Desplaines Valley & North-Western Railway, now under way. This line is practically a cut-off from the Wisconsin and Milwaukee Divisions to the Galena Division. It is to be a freight road and will divert west-bound freight coming from the north and northwest entirely from terminal territory and from the regions of greatest suburban passenger train congestion. That advantage will amount to much in dollars and cents, but will also mean much toward ease of train operation and elimination of delays, both to passenger and freight traffic.

At the Proviso yard there are wye track connections with the B. & O. Chicago Terminal Railroad. This is a belt railway, and much freight will be transferred here for local delivery, and for transfer to other roads. Ample trackage is provided and transfer movements will not interfere with main line traffic. This yard is in two parts, situated north and south of the main lines, and connection is made with the Terminal Railway from both sides. The Terminal Railway crosses above the North-Western at this point, and the wye tracks are rather long in order to get up to the higher level of the Terminal's tracks. The combination of the new Desplaines Valley Railway and the Proviso yard in direct connection with this "belt" railway will give high efficiency in the delivery of local freight, and in the transfer of freight to other railways, while at the same time it will relieve the busiest portions of the railway and of the city of much freight traffic.

Through freight coming from either the Wisconsin or Milwaukee Divisions and bound for the west (or vice versa) will be diverted over a shorter route, and a route which will be negotiated at a faster rate on account of low gradient, few curves and these of light curvature, much lighter traffic and no "superior" passenger trains, and fewer interlocking plants. The old route from Desplaines to Elmhurst was across the Mayfair cut-off to 40th Street yard, and then out the Galena

Filling-in a Temporary Trestle.

Temporary Span Over C. M. & St. R. Ry.



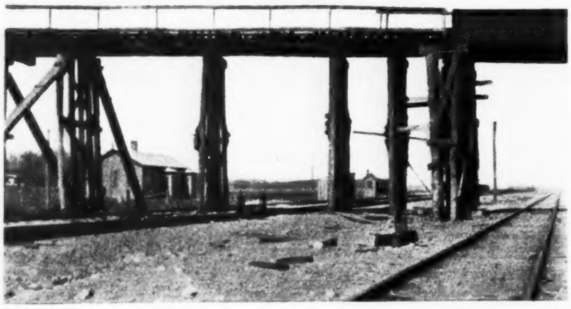
Abutments and Piers for Desplaines River Bridge, North Section.

Division. The distance between Mayfair and Elmhurst by this route is over 25 miles, while the new route will be about 12 miles. The distance from the junction with the Milwaukee Division to Elmhurst will be about 20 miles on the new line; this will also be a big saving in distance.

With the completion of the work now under construction in Chicago, the terminal capacity for passenger trains will be amply increased, and not only that, but the diverting of freight traffic will greatly relieve the down-town section.

Construction Features of the Desplaines Valley Railway.

A location survey for the Desplaines Valley Railway was run several years ago, but nothing was done in the way of construction. In 1909 a re-location was made and construction work started in 1910. The work was started with a rush, but later was held up and little was accomplished in that year.



Trestle Over Side Tracks, South of Span Crossing Milwaukee Main Tracks.

This line will connect with the Milwaukee Division near Blodgett and with the Galena Division at Elmhurst, crossing the Wisconsin Division just north of Desplaines. Wye track connections are designed for each junction. The part of the line between the Milwaukee and Wisconsin Divisions is designated the north section, during the construction, and that between the Wisconsin and Galena Divisions is called the south section. The railway company is now constructing the south section. All of the work is company work, except the fencing, some of which was contracted.

There are to be two overhead railway crossings on the completed line, both of these to be over the Chicago & Milwaukee Railway. One of these overhead crossings is in the south and the other is in the north section. There are also two railway crossings at grade, the lines crossed being the Wisconsin Division of the North-Western, and the other the Minneapolis, St. Paul & Sault Ste. Marie Ry. Both of these are double track lines. The grade crossings will be quite close together, and just north of the present crossing of the M., St. P. & S. Ste. M. Ry. and C. & N.-W. Ry., Wisconsin Division. It is evident that a great deal of money is being spent in order to eliminate railway grade crossings wherever possible and also to a lesser extent highway grade crossings.

The feature of the work in the south section is the overhead railway crossing of the C., M. & St. P. Ry. There is to be a two-span bridge at this point, one span a truss with 131-foot opening, the other a girder with about 88-foot opening. The grade leading up to this bridge is 0.3 per cent on either side and the total fill from cut to cut will be four miles long and contain 900,000 cu. yards. This fill is 32 feet high in some places. In the south section there are to be four highway subways, and in the north section the plans call for four subways and two overhead bridges for highways.

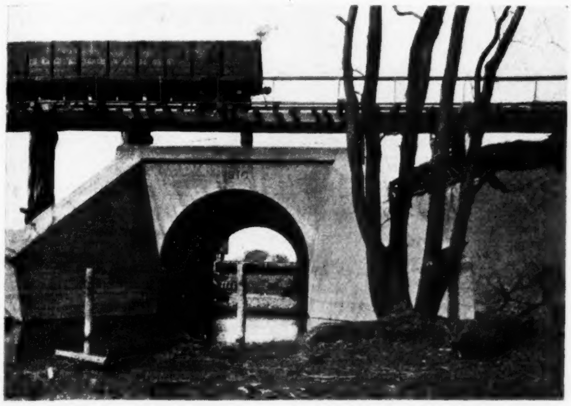
The new line is to be double track of 90-lb. rail A. R. A. section. The ties are of hemlock treated with creosote at the large and up-to-date C. & N.-W. creosoting plant at Escanaba, Michigan. The maximum gradient is 0.3 per cent, and the maximum curvature is 2 degrees. On the main tracks there is only one curve which will have the maximum of 2 degrees, the rest are all of lighter curvature. Exclusive of wye tracks there are only four curves on the line. On the wye tracks a curvature as high as 8 degrees has been used.

The method used in construction was to first lay a temporary track along the edge of the right-of-way, beginning at both ends of the line. A through connection of this track was not possible without putting in a grade crossing over the C., M. & St. P. By using this temporary track, work on the temporary pile bridges, on concrete culverts, etc., could be started all along the line. One track was then started by the track gangs, on its correct center line, and this construction was handled so as to interfere as little as possible with the other work. Where the fills were to be low, or where the track was to run through cuts already graded, this track was made permanent, the filling hauled in and the track raised to grade. Where the fill was to be high, and the track would have to be lifted many times, a temporary track of second hand steel and cedar ties was used. Where the fill was very high, as approaching the C., M. & St. P. crossing, a temporary trestle was constructed. Two such trestles were used in the south section. The structure ap-

Sink Hole, Showing Flowing of the Earth.

Temporary Trestle, Showing Bracing.

proaching the crossing is over 30 feet high, and is made of rather small piles, 5 in a bent. The structure was made safe by bracing every fourth bent with second-hand 8x16-in. stringer timbers. These trestles are to be filled in as rapidly as possible, and as they will not have to carry the track very long, and will be buried and left in the embankment, they were made as light and cheap as was consistent with safety. There is one long span in the temporary trestle structures, this being directly over the Milwaukee railway main tracks. A second-hand through girder span was used, the opening being about 30 or 35 feet. The ends of this girder are supported on bents consisting of a double row of closely driven piles.



Reinforced Concrete Arch Culvert, with Temporary Trestle Above.

The placing of this span was accomplished without delay to traffic on the Milwaukee.

The track on center has been laid clear through and partially raised. It is intended to raise this track to grade and build the fills for the second track from the first. Wherever practicable the unloading of filling has been done by a dirt plow and Lidgerwood unloader. A great deal of black stripping from a quarry is being handled in bottom dump coal cars; the latter are used advantageously for filling in trestles. The Lidgerwood and side plow can be used to great advantage in building the grade for the second track, in connection with a first class bull dozer or

Temporary Water Tank.

gravel spreader which is on the work. The cars unloaded by the dirt plow are swing side gondolas, with the ends removed, fitted with sheet iron aprons to close the gaps between cars.

On the south section there are two reinforced concrete culverts. They are of attractive design and have been neatly constructed.

One large sink hole has been encountered, and it is said that the track over it has been raised and reraised a total of over 100 feet. On one side of the track the earth is oozing up and flowing outward, and the earth has humped up 10 or 15 feet close to the foot of the slope.

There is illustrated herein an unusual type of water tank. It is square and was designed and erected entirely by the company construction forces with ordinary lumber. This tank is now furnishing the construction locomotives with water.

There are a number of places where interlocking is to be installed. The junction with the Galena Division is close to an interlocking plant, which handles the turnouts onto third and fourth main lines. The junction with the Wisconsin Division is close to the present interlocking for the M., St. P. & S. Ste. M. Ry. crossing with the Wisconsin Division. The crossing of the Desplaines Valley Railway and the M., St. P. & S. Ste. M. Ry. will require protection, as will also the junction with the Milwaukee Division at Bensonville. It is likely that the entire line will be fitted with automatic block signals.

With the exception of the fills for eliminating grade crossings, the grading work is not heavy, as the country is in general quite level. The low gradient used will allow the operation of heavy tonnage freight trains. The location and construction of this line are similar to and in a class with the high grade of the Chicago, Milwaukee & State Line built in 1906.

MT. UNION TIE-TREATING PLANT, PENNSYLVANIA R. R.

The Pennsylvania Railroad Company, in awarding a contract for the erection at Mt. Union, Pa., of a "one-cylinder" plant for the treatment of timber by any standard process, has taken the initial step toward the preservative treatment of its cross-ties and other timbers. In connection with this plant, two creosote storage tanks of 500,000 gallons capacity each are to be erected at Greenwich Point, Pennsylvania. These tanks will have a combined capacity sufficient to receive a full tank steamer cargo of oil. The treating plant will have a capacity of from 1,500 to 2,000 ties a day, if day and night shifts of hands are worked. This will give an annual output of about 500,000 ties.

Mt. Union was selected as the site for the first plant because it is near the center of a tie producing region, and, in addition, is a convenient receiving and shipping point. The plant is to be located on a comparatively level tract of company land comprising about 50 acres, directly north of the new line. Connections from the tie yard and loading platform to the old main line—now a freight yard—will be made by a track under the new stone arch bridge over the Juniata River at this point. (The narrow-guage East Broad Top Railroad also will have connections with the yard.)

During 1907, 840,000 hardwood ties were obtained along the Middle Division of the Pennsylvania Railroad, while the Eastern Pennsylvania Division of which the Middle Division is a part, produced 1,250,000 ties. Eliminating the white oak and chestnut, which do not take treatment readily, and including the miscellaneous hardwoods, such as beech, maple, and birch, which, if treated, make excellent ties, the territory tributary to Mt. Union should produce enough ties to supply a one-cylinder plant for many years to come. Other plants, if built, will probably be located at Tidewater points tributary to the larger supplies of treatable Southern woods, such as gum, mixed oak, and shortleaf and loblolly pines.

The Mt. Union tie yard will occupy an area of about 17 acres. There will be six tracks about 1,500 feet long, and 73 feet apart. There will be ample space for adding other tracks as they are needed. The capacity of the yard will be from 450,000 to 600,000 ties, depending on the height to

which they are piled. All timber treated will be given not less than six months of summer seasoning in this yard.

The treating cylinder and machinery to be used in the plant are as follows:

One (1) treating cylinder 6′ 2″ x 131′ 0″, complete with dome, steel float, and dial; cast steel door at one end, fastened to frames by means of 28 steel bolts 2½″ in diameter; steel angle rails of inverted type, 24″ gauge, supported upon steel brackets with guards; heating coils and hoods; 4″ perforated wrought iron agitation pipe for the Card process; saddles, foundation bolts, etc. The shell is to be ¾″ boiler steel made of 17 plates sheared, with bevel not to exceed one to three, longitudinal seams butt-strapped inside and out and triple riveted, circular seams to be double-riveted, lapped joints and all rivet holes seamed. The maximum stress is not to exceed 1,500 pounds T.S., while the shell and all the parts are designed for a hydraulic working pressure of 200 pounds to the square inch.

One (1) 4,320-gallon measuring tank 9′ 0½″ diameter by 9′ 0″, with heating coils, air coils, measuring board, etc.

One (1) 28,800-gallon working tank, 17′ 6″ x 16′ 0″, with cover, heating coils, etc.

One (1) 100,000-gallon creosote storage tank 28′ 7″ x 21′ 0″, open at top but with heating coils, etc.

One (1) 20,000-gallon wood zinc-chloride solution tank 14′ 3½″ x 16′ 8″ for Card process.

One (1) 45,000-gallon water tank 17′ 0″ x 29′ 6″, with hemispherical head and tower.

One (1) Air Compressor duplex size 10″ x 10″ x 12″ with an air receiver 5′ 4″ x 10′.

One (1) vacuum pump with jet condenser 14″ x 20″ x 24″.

One (1) circulating pump duplex.

One (1) pressure pump special duplex 7½″ x 4½″ x 6″.

One (1) service pump special duplex 8″ x 7″ x 12″.

One (1) fire pump duplex 12″ x 6″ x 12″.

One (1) centrifugal 6″ special pump (for Card process) direct connected to engine.

One (1) 10-K.W. generator direct connected to engine.

One (1) 150-H.P. 125-lb. steam pressure boiler with corrugated flues.

Two (2) double drum double cylinder hoists 8″ x 12″, with sheaves, operated by compressed air.

Eighty (80) tie cars with roller bearings.

Twelve (12) Bolster cars with roller bearings.

While the plant will be equipped for any process of recognized value, it will operate mainly with creosote. The agitating pipes and rotary pumps are for the use of an emulsion for zinc-chloride and creosote. This process materially reduces the cost of treatment, and it is anticipated that it will find application in the treatment of certain woods which do not readily take creosote, and that with these woods the maximum absorption of creosote can be given and in addition the center of the timber impregnated with zinc-chloride combined with the lighter creosote oils which will be filtered out of the emulsion and carried in with the zinc-chloride during treatment.

In addition to the above a small experimental cylinder to hold three ties, with the necessary tanks, pumps, etc., is to be installed. This cylinder is designed for a working pressure of 400 pounds to the square inch and must meet very exacting conditions in the experimental treatment of the refractory woods available in Central Pennsylvania.

Salisbury Viaduct, Western Maryland Railway.

The Salisbury Viaduct at Station 630 of the Connellsville & State Line Railway, an extension of the Western Maryland Railway, is a double-track plate-girder structure about 100 ft. high and 1,908 ft. long, face to face of back walls on abutments. The construction is illustrated in the accompanying drawings taken from the Engineering Record. It has alternate 30-ft. and 60-ft. spans, except at the crossings of the river and of the Baltimore & Ohio Railroad, where there are two spans, 92 ft. 6 in. center to center of bents, with two 40-ft. tower spans adjoining each; and at each end, where there are two adjacent 60-ft. spans supported on the same vertical rocker bent between them. With these exceptions all of the spans are supported on two-bent steel towers 30 ft. long, each of the four columns having a pyramidal concrete pier carried up 2 or 3 ft. above the surface of the ground. All of the piers are rectangular except five in the river channel which are oblong, with pointed upsteam ends. The viaduct is on a grade of 0.8 per cent and is on a tangent.

The spans have two lines of deck plate girders for each track, but provision is only made for one track at present, the longitudinal girders for the other track not being installed until required. The longitudinal girders are of ordinary construction, with T-shape flanges made of pairs of 6x6 and 8x8-in. angles, with 14-in. and 16-in. cover plates, respectively, and are 87¼ in. deep, back to back of angles, for the 30, 40 and 60 ft. spans, and 111¼ in. deep for the 92 ft. 6 in. spans. The 92 ft. 6 in. spans are seated directly on the transverse tower bents, with one fixed end and one expansion end for each girder, and the 40-ft. spans are built with stools integral with the girders to make up the difference in depth of webs. The 60-ft. girders have sole plates riveted to their bottom flanges and riveted to the transverse girders at fixed points and connected to them with bolts and clip plates at expansion ends. The ends of the 60-ft. girders on rocker bents have pin bearings in cast-steel pedestals and shoes fixed to the transverse girder of bents.

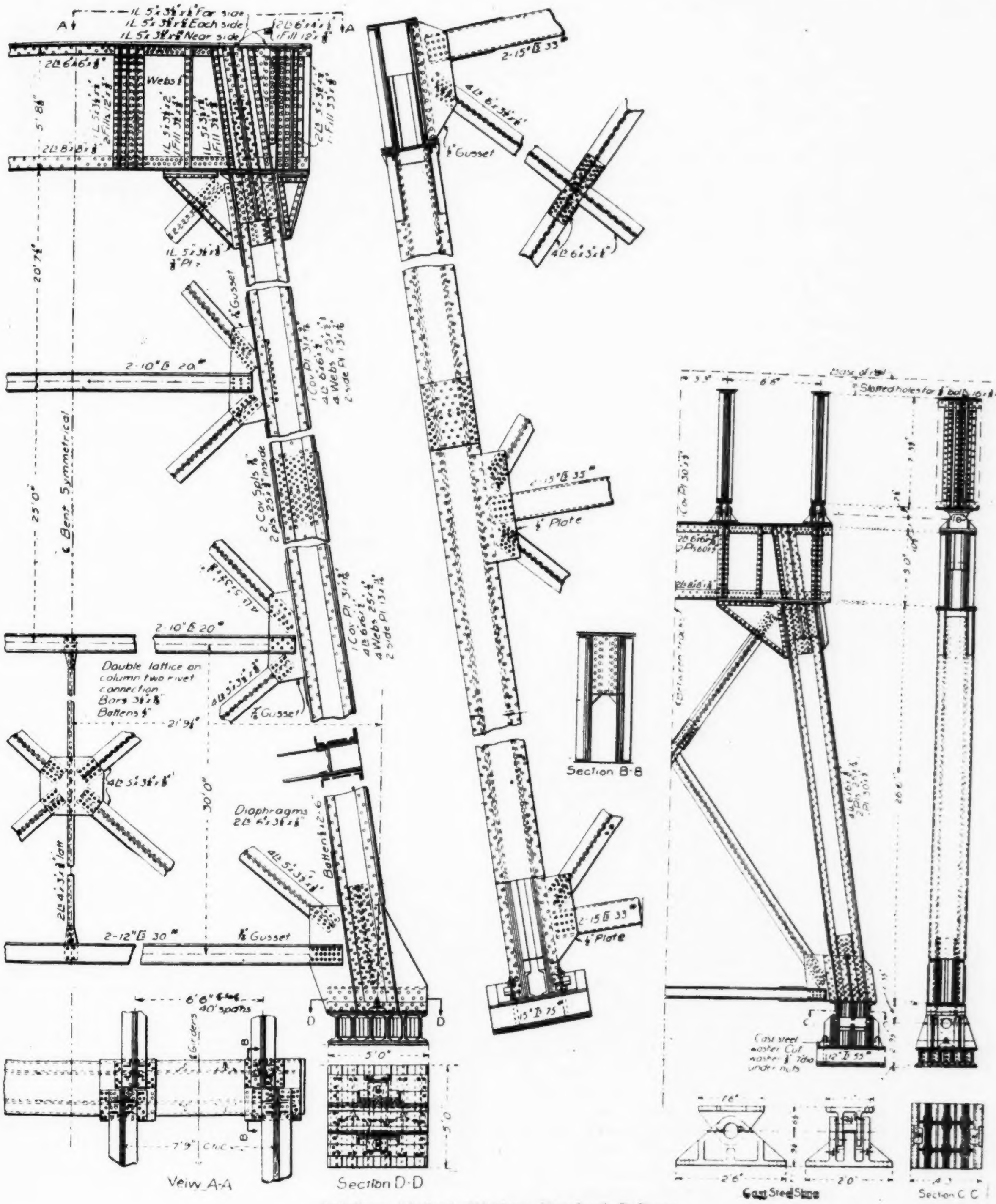
The structure is built in accordance with the specifications of the Western Maryland Railway, as revised June 7, 1910, and provides for one 320-ton Mallet locomotive followed by a train load of 5,500 lbs. per linear foot of each track. The dead load of the track is assumed to be 700 lbs. per linear foot, and the estimated shipping weight of the 30, 60 and 92-ft. 6-in. girders are, respectively, 10 tons, 33 tons and 77 tons per span per track. The total weight of the superstructure, exclusive of the longitudinal girders for one track which are not included in the present contract, is about 2,600 tons.

Each tower has two vertical transverse bents made with a pair of battered columns, with X-bracing in all the panels between horizontal longitudinal and transverse struts. The columns are made of two built channels, with a cover plate on the outer flanges and latticing on the inner flanges, and are field-spliced with web cover plates shop-riveted to the lower section and flange cover plates shop-riveted to the upper section. Pairs of jaw plates are shop-riveted to the webs and to the flanges to afford connections for the field-ripeted horizontal and diagonal braces, the former made of pairs of channels back to back, with their webs in vertical planes, and the latter having I-shape cross-sections made of four angles each, latticed, one diagonal being continuous and the other diagonal being cut to clear it at intersections and spliced to it by flange cover plates field-riveted to both members. All diagonal braces are considered as tension members only.

The columns have horizontal cap plates, on which are seated the bottom flanges of box transverse girders about

5 ft. 9 ins. deep and 21 ft. 8 ins. to 22 ft. 11 ins. long over all. These girders are double-balanced cantilevers, which overhang the columns centers from 2 ft. 3 ins. to 2 ft. 9 ins. at each end, and are very rigidly connected to the columns by solid web knee-braces on both sides of each column and by diaphragms extending about 3 ft. into the column section and about 3 ft. up into the box girder and riveted to both, with their outside web stiffener angles ground to bearing at both ends and the lower edge of the web faced to bear on the column caps.

The two tracks are 13 ft. apart on centers, and the longitudinal girders for each track are 7 ft. 9 ins. apart in the 92-ft. 6-in. spans, thus bringing the outside girders entirely clear of the columns. In the 60, 40 and 30-ft. spans the longitudinal girders are only 6½ ft. apart. This distributes one track load to each column under any condition of loading and justifies the design of the columns for the full specified impact allowance for members loaded by one track only, instead of 80 per cent of the impact by formula, as specified for members loaded by two or more tracks. It permitted the columns to be battered 1:6, which is considered by the designer to be unusual for a double-track viaduct, and de-



Salisbury Viaduct, Western Maryland Railway.

pressed the intersection of the column axes considerably below the point at which it would occur if the columns were outside the tracks. It reduced the transverse stresses and effected a material economy in the weight of the transverse girders and bracing. The girder webs are connected by vertical transverse diaphragms at the longitudinal girder connections and over the column bearing, the latter extending only part way from bottom to top flanges and being field-riveted in position in the planes of the columns.

The columns have extended bases made with projecting web plates and transverse channels, forming a construction substantially integral with the pedestal that distributes the load across the I-beams in the pier grillage which projects just above the top of the concrete. Although it is calculated that there is no uplift under any conditions, it was thought wise to utilize the weight of the concrete pedestal for additional stability, and each column is anchored by two 2-in. vertical bolts 12 ft. long that pass through 6-in. holes in the base plates and have bearing for the nuts at their upper ends on thick cast-steel washers covering the holes in the base plates. The 2-in. bolts pass through 6x2¼-in. slots in the cast-steel washers, and the latter are free to move on the column bases in a direction perpendicular to the longitudinal axis of the slot, thus providing adjustment of 2 ins. in all directions for the column bases on the anchor bolts. The lower ends of these rods pass between a pair of horizontal angles and have heads bearing on their bottom flanges. These angles take bearing adjacent to the rods on the flanges of transverse horizontal angles 8 ft. long, forming with them a sort of reaction frame work, which distributes the pressure over nearly the entire area of the concrete pedestal, so as to utilize all of the weight of the concrete above it. In order to provide for any inaccuracy of measurements or of setting the bolts, conical holes 6 ins. in diameter at the top were cored around the bolts in the concrete, providing abundant clearance and adjustment for setting the tower columns, after which the holes were grouted. This is in addition to the adjustment provided by the 6-in. holes for 2-in. bolt with cast-steel slot washers described above.

The rocker bents at each end of the viaduct are not quite as tall as the towers. Their columns correspond to the tower columns except that they are made in single pieces and are braced only by a bottom horizontal transverse strut and one panel of transverse X-bracing. Their bases are bolted to triple-web riveted shoes engaging 8-in. pins through corresponding riveted pedestals, with anchorages and grillages as already described.

The adjacent ends of the 60-ft. longitudinal girders supported by these bents are bolted together through their edge of the conduit to be at least two feet below the top surface. The conduit should be laid to drain from manhole to manhole or from center of run to each manhole. The

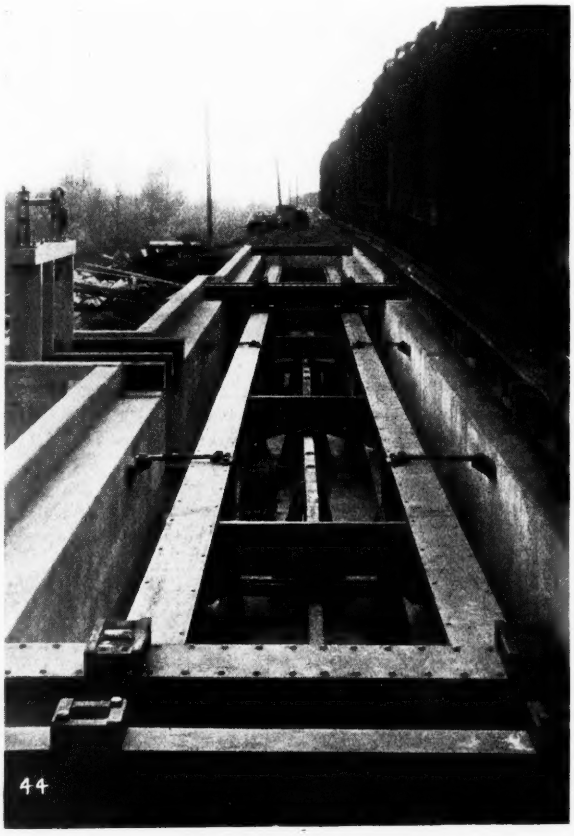
The trench should be dug deep enough to allow the top end vertical web stiffener angles and have a common support on a tripple web cast-steel shoe bolted to the bottom flanges and engaging a 4¼-in. pin through a corresponding cast-steel pedestal bolted to a ¾-in. bearing plate on the top flange of the transverse girder. The flexure of the outstanding 6-in. legs of the end stiffeners is thought to be sufficient to prevent any appreciable continuity due to this connection, but for precaution this connection is bolted instead of being riveted.

The viaduct was designed and is being constructed under the direction of the engineering department of the Western Maryland Railway, Mr. H. R. Pratt, chief engineer; Mr. C. P. McCausland, bridge engineer, and Mr. A. W. Buel, New York, consulting engineer. The McClintic-Marshall Construction Company is the contractor for the fabrication and erection of the superstructure.

SCALE EMBODYING NEW FEATURES IN DESIGN.

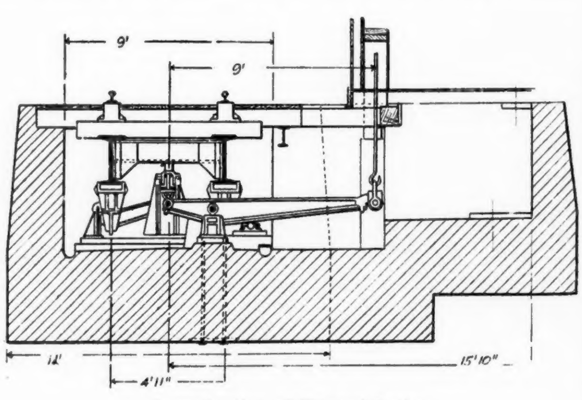
Unique among scientific methods employed by the Pennsylvania Railroad is a scale for weighing cars while in motion, which has just been installed at West Brownsville Junction, Pa. This fifty-two foot track scale with mechanical hump has many advantages over older types.

The increase in weight of rolling stock during the last few years has rendered many track scales incapable of sustaining

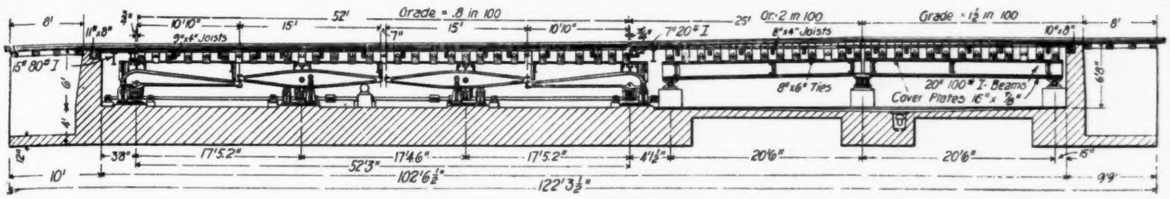


Heavy Frame for Track Support.

the heavier loads without serious errors. Probably the most ingenious feature of this new scale is what is called a relieving gear, an arrangement of jacks operated by power, which permits the scale mechanism to be completely disconnected from the track. For this reason only one track is needed over the scale, while in older designs two were necessary. When not being used for weighing, the track is let down by the relieving gear, and rests on solid founda-



Cross Section of Pit and Scales.



Longitudinal Section, Mechanical Hump Scale.

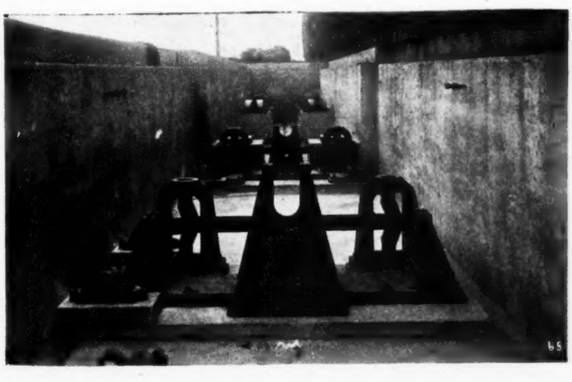
tions, entirely separate from the scale mechanism so that heaviest engines can pass over the scale without registering a pound's weight; the disconnection is made without the least effect on the balance of the scale. The relieving gear does away with the bulky supporting columns that, with the old style scale, encumber the vault under the tracks and prevent proper inspection and maintenance of the bearings and other vital parts.

Wind pressure or snow and ice on the platform will not affect the balance of this scale, for the surface platform is

Finished Scale and Scale House.

supported entirely independent of the scale mechanism. The design is such that it practically assures immunity from freezing.

The mechanical hump is adjustable and this makes it possible to regulate the velocity at which the cars go on to the scale. By raising or lowering the apex of the hump, the grade down which the cars run is increased or diminished at will. This is important because on different styles of cars the distance between the front and rear wheels varies, and as the weight can only be registered during the interval between the times when the rear wheels pass on to the scale and front wheels pass off the velocity must vary inversely with the length of the wheel base.



View in Pit During Construction, Showing Supports for Scale Mechanism.

FORTUNE FOR REMOVING A WRECK.

It was a strange task which confronted the contractor who undertook to remove the wreckage of the collapsed Quebec bridge. Nine thousand tons of steel, bent and twisted into indescribable confusion, lay between the shore and deep water. There was no place to begin, for there were no loose ends. So well had the steel makers done their work that but a single eyebar was broken in the collapse. Starting in January, 1910, the contractor was allowed until May 1, 1911, a period of less than sixteen months, in which to clear away the wreckage, including all that showed in the river at low water.

Two months were spent in experimenting, trying to find a vulnerable spot in the wreck and some efficient method of cutting up the ponderous members of the bridge into bits that could be handled. These experiments brought out the fact that there were just two means at hand, one being dynamite, the other the oxy-acetylene flame. Each was peculiarly adapted to certain conditions, so that each supplemented the other. Together they have performed feats not matched in the annals of engineering.

Dynamite worked particularly well under water. One stick of the explosive would break a plate half an inch thick, while to break a plate an inch thick two sticks were required. In order to cut one of the great girders, sticks of dynamite were placed end to end across it, usually tied to a stick of wood or placed in a piece of cheap rubber hose. If the cut was to be done under the water the explosive was placed in position at low tide. Then the workmen waited until the tide rose, thus affording a water tamping. Above high water the charge was covered with a few inches of earth. Extra precautions had to be taken in seeking shelter when a charge was to be fired, for pieces of steel were thrown great distances. One piece was thrown across the river. Twelve tons of dynamite were used in breaking up the south anchor arm.

Oxy-acetylene gave remarkable results. It was used to greatest advantage in cutting the heavy chords and posts into pieces. The flame cut very rapidly, leaving a narrow, sharply defined slot not wider than a saw would make. A square inch of steel could be cut through in 5⅝ seconds with 0.4 of a foot of gas costing 1.2 cents. An eyebar 2 inches thick and 10 inches wide was cut through in one minute and fifty seconds with the flame. This method proved very convenient, for as the torch weighs but a few pounds it could be carried around anywhere. With all this the work was tedious; when ten of the sixteen months had elapsed but half the wreckage had been removed. The contractor, who gets $45,000 and the scrap, doubtless feels that he is earning his money.—From "Rebuilding Quebec's Fallen Bridge" in May Technical World Magazine.

Official announcement is made that the Chicago, St. Paul, Minneapolis & Omaha will spend about $1,000,000 in improving proving its terminal facilities in Minneapolis. Property has been acquired covering seven city blocks, close to a number of industries on the north side.

The Signal Department

We publish this month the signal standards of the "Harriman Lines" than which no other system of roads has more mileage automatically protected. These roads, and particularly the Southern Pacific, have lead the world in three things, so far as signaling is concerned. They were the first to take full advantage of automatic protection on single track and have more miles of this class of signaling in service than any other system; they were the first to develop the portable storage battery to its highest point of efficiency for signal service and now use no other source of power for automatic block signals, and they have carried the "common" standard idea to the point of maximum efficiency, so that now one set of plans or specifications serves for all the roads. Yet this has not proved a check on improvement in design or methods, as the standards are changed from time to time after thorough investigation. Behind all this we find, as the moving spirit, W. W. Slater, signal engineer of the Southern Pacific, to whom, more than any other man, is due credit for the present state of the art of signaling of the Harriman Lines.

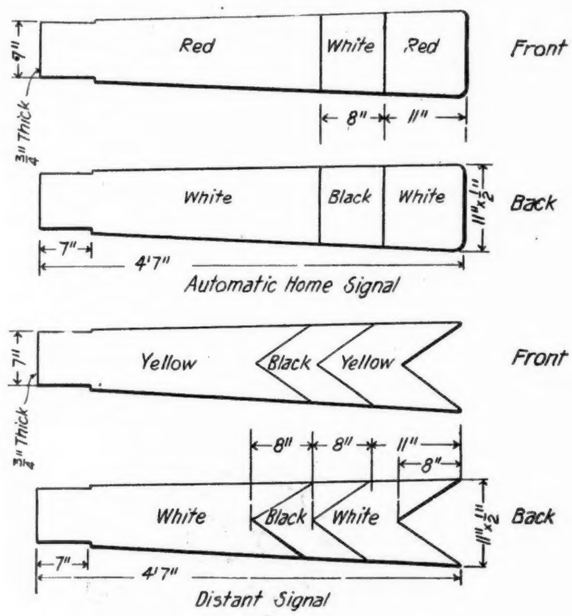


Fig. 380. Home and Distant Blades, S. P. Co.

RAILWAY SIGNAL STANDARDS NO. 17, THE SOUTHERN AND UNION PACIFIC.

The practice on all the roads comprising the so-called "Harriman Lines" is so nearly uniform that separate descriptions are unnecessary. These roads use electric motor signals of the lower quadrant, two position type like that illustrated in Fig. 59. The night color indications are red for stop, green for clear, and yellow for caution. The blades are shown in Fig. 380. Signals have two arms on double track in general and one arm on single track. They are mounted on concrete foundations, Fig. 381, except at temporary locations and under adverse conditions where wooden foundations are used. Signals are operated by portable storage battery contained in carrying cases. Fig. 382 shows a portable cell. No. 6 B. & S. gage copper terminal wire is soldered into the pillar strap so as to make perfect electrical contact. In the cut, A is a No. 6 (162" diameter) B. & S. gage copper wire 2½ inches long above pillar. B is a lead pillar 1½ inches long. C is a hard rubber stopper. D is a hard rubber jar, 7x5$\frac{5}{16}$x2⅝ inches outside. Weight complete with acid does not exceed 13 pounds. Capacity at 8-hour rate is not less than 50 ampere-hours. The same battery operates the signal and feeds line circuits.

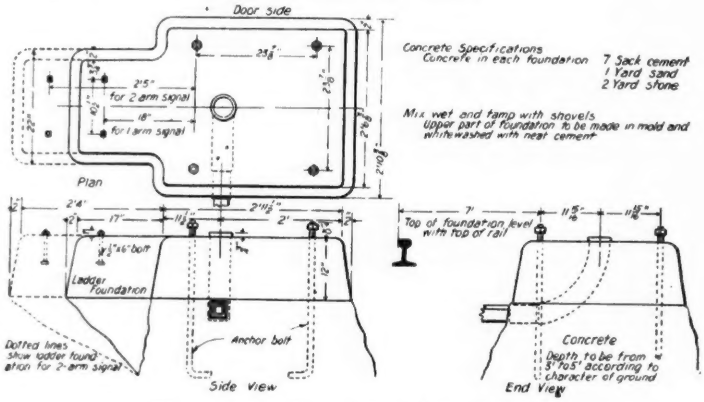


Fig. 381. Concrete Signal Foundation, S. P. Co.

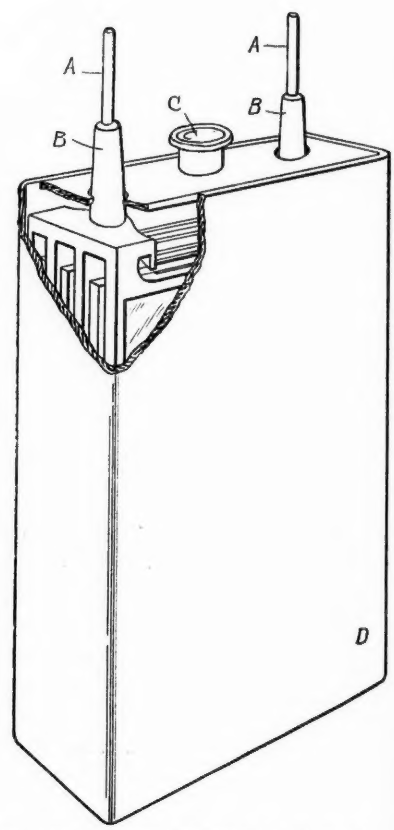


Fig. 382. Portable Storage Cell, S. P. Co.

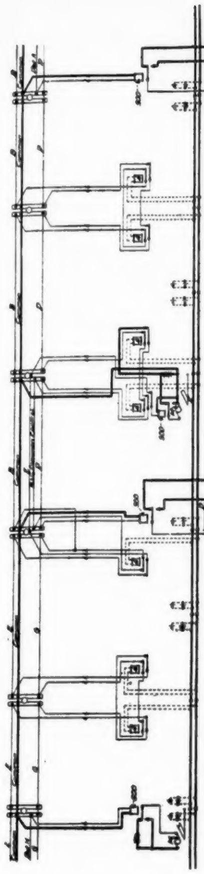


Fig. 385. Circuits for Automatic Block Signals Between Stations on Single Track, Four Cut Sections, S. P. Co.

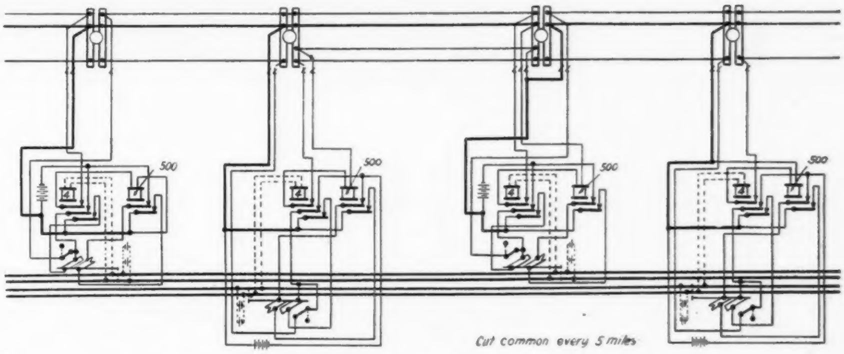


Fig. 383. Typical Neutral Circuits for Double Track Automatic Block Signals, S. P. Co.

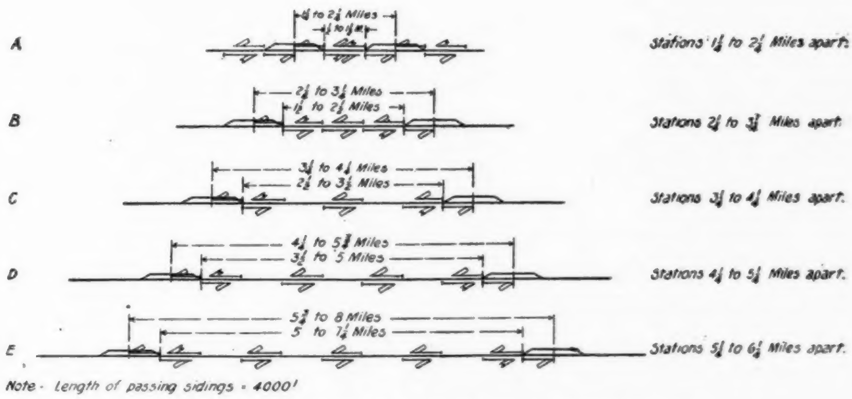


Fig. 384. Arrangement of Automatic Block Signals Between Stations, S. P. Co.

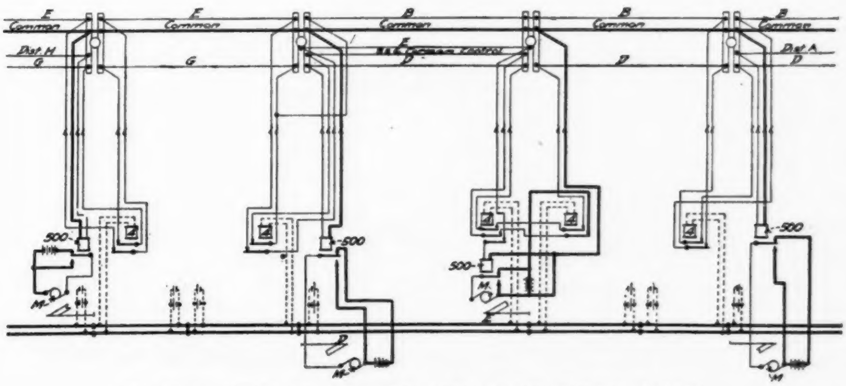


Fig. 387. Circuits for Automatic Block Signals Between Stations on Single Track, Two Cut Sections, S. P. Co.

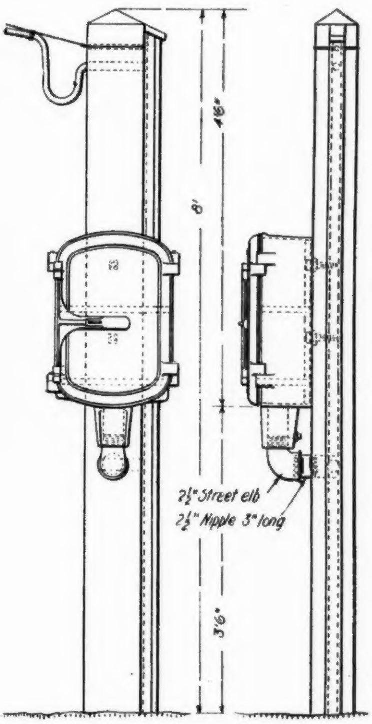


Fig. 399. Iron Relay Box on Wooden Post, S. P. Co.

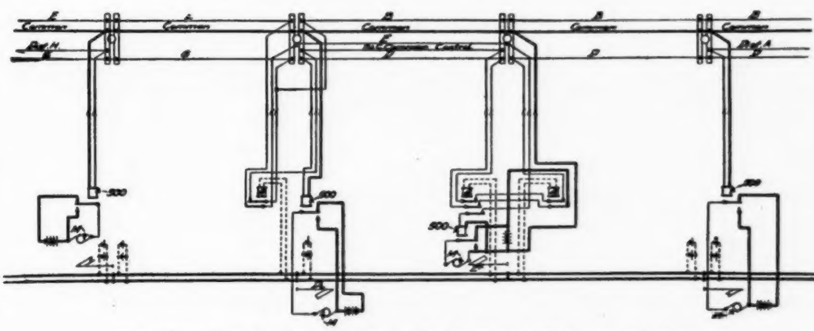


Fig. 386. Circuits for Automatic Block Signals Between Stations on Single Track, No Cut Sections, S. P. Co.

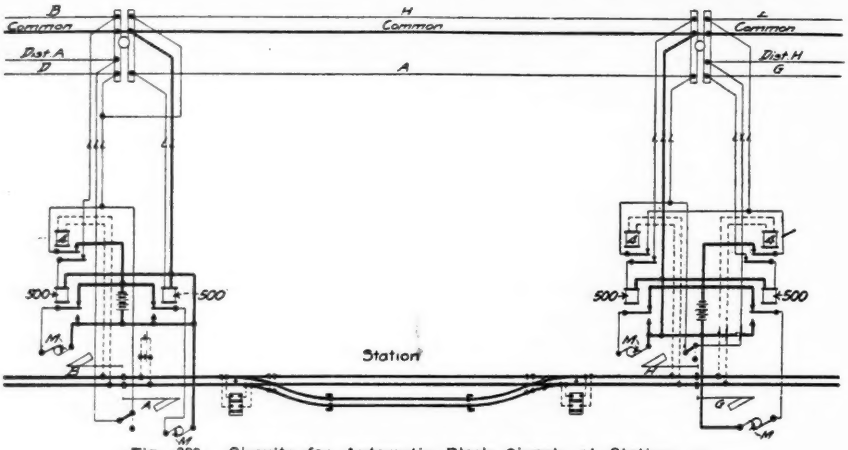


Fig. 389. Circuits for Automatic Block Signals at Stations on Single Track, No Cut Section, S. P. Co.

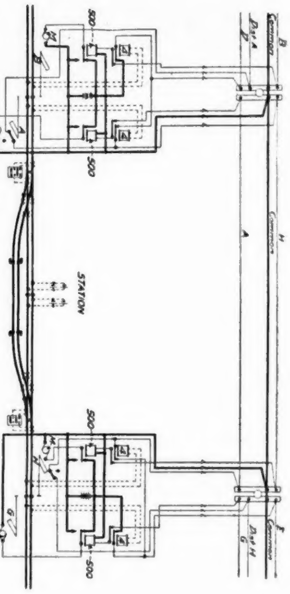


Fig. 390. Circuits for Automatic Block Signals at Station on Single Track, Cut Section, S. P. Co.

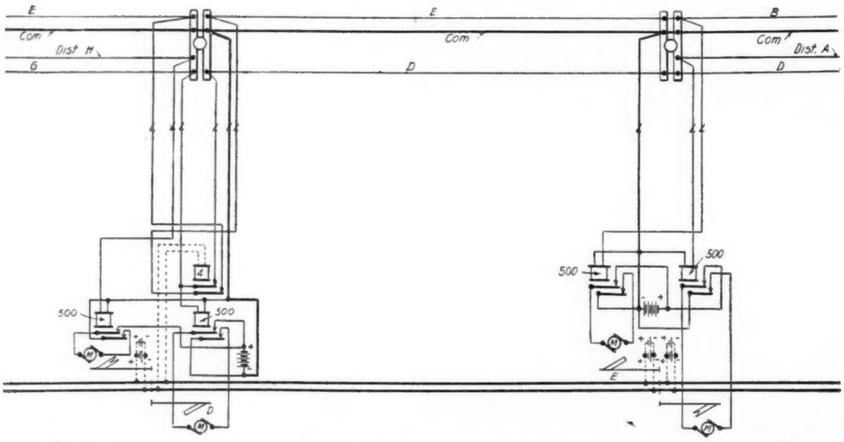


Fig. 388. Circuits for Automatic Block Signals Between Stations on Single Track, Distant Signals Opposite Home Signals, S. P. Co.

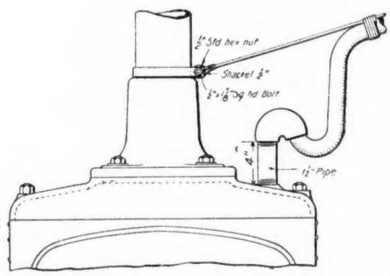


Fig. 395. Conduit and Messenger Clamp for Top of Signal Case, S. P. Co.

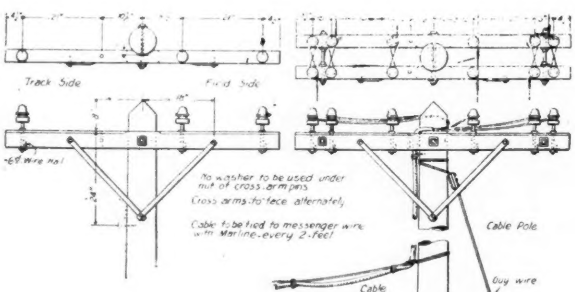


Fig. 391. Details of Pole Line Construction, S. P. Co.

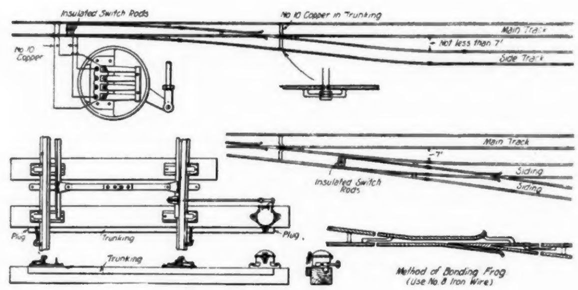


Fig. 396. Switch Wiring, S. P. Co.

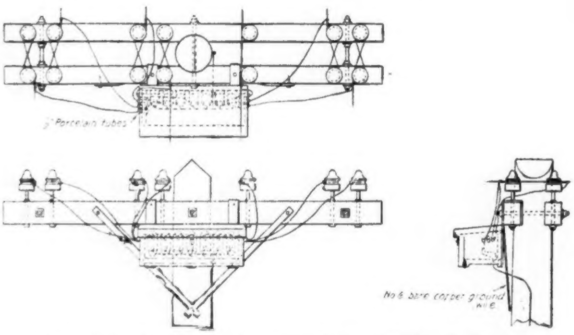


Fig. 392. Lightning Arrester Box on Pole, S. P. Co.

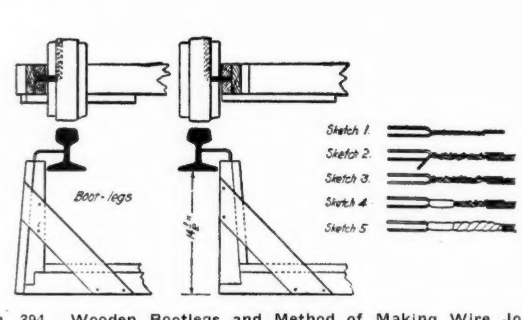


Fig. 394. Wooden Bootlegs and Method of Making Wire Joints, S. P. Co.

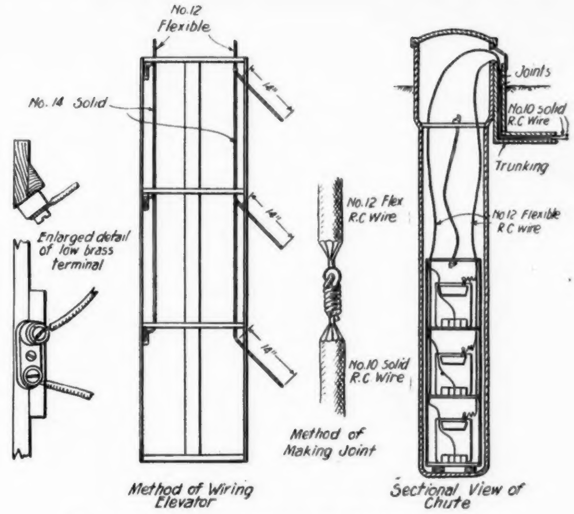


Fig. 393. Battery Chute and Elevator, S. P. Co.

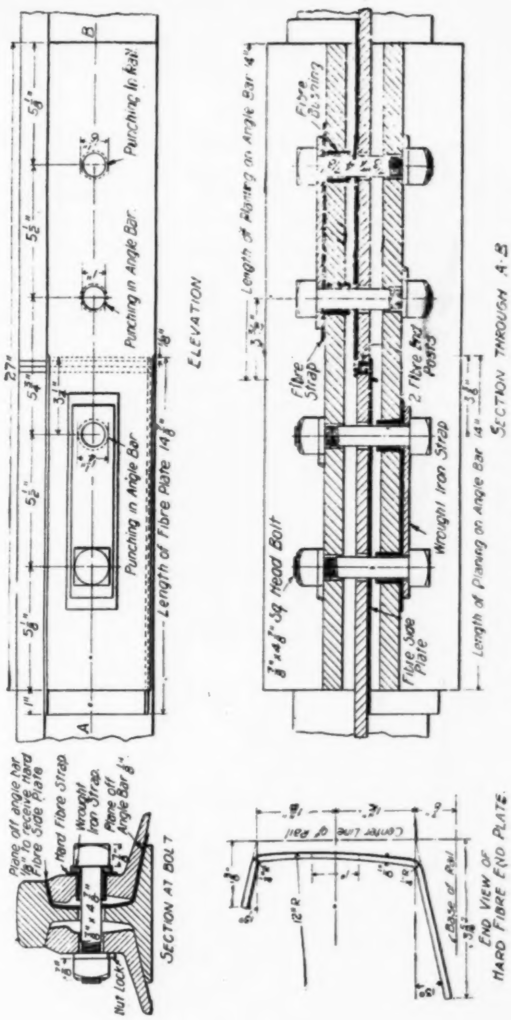


Fig. 398. Insulated Rail Joint, S. P. Co.

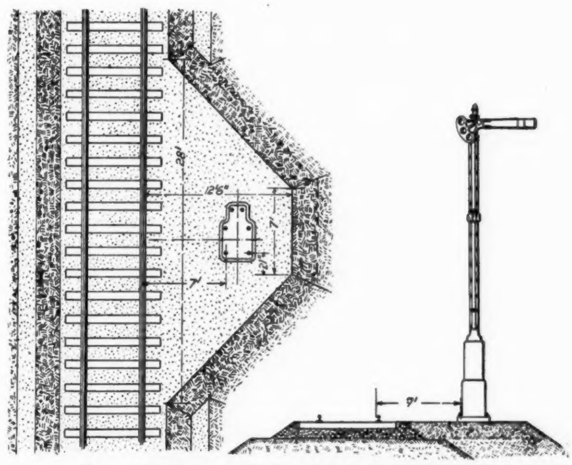


Fig. 400. Signal Foundation on Embankment, S. P. Co.

On double track the polarized track circuit is sometimes used, Fig. 71, but the standard circuit is neutral, Fig. 383. Here common is broken every five miles. No overlaps are used on double track. On single track signals are arranged as shown in Fig. 384. Figs. 385-390 show typical circuits for various situations. Switch indicators are not used.

A separate pole line is provided for signal circuits. Fig. 391 shows pole line details and Fig. 392 the method of installing lightning arresters.

Track battery consists of two or three cells of gravity battery housed in iron chutes, Fig. 393. The signal battery is housed in an iron case at the base of the signal. Track circuits are from 2,500 ft. to 4,500 ft. in length. Blocks vary from one to two and one-half miles.

Storage battery is charged at a central charging station, or in a special car. When charged at a central plant, they are distributed by local freight or in the baggage car of a passenger train.

Wire ducts consist of wooden trunking above or below ground. Fig. 394 shows a wooden bootleg and method of making wire joints. Here 1 shows the iron wire as first formed for the connection. 2 and 3 show the method of splicing the copper to the iron wire. 4 shows the soldering, which should be well applied toward the end of the joint, so as not to injure the insulation of the copper wire. 5 shows the joint taped and painted. Iron wire to be No. 8 B. W. G. Ex. B. B. galvanized. Copper wire to be No. 10 B. & S. rubber insulated with 5/64-in. wall, 1 tape and 1 braid. Acid must not be used in soldering. After soldering, joint must be well coated with No. 2 P. & B. paint; wrapped with 1 layer of tape; then painted again with P. & B.; then 1 layer cloth tape and a coat of P. & B. paint over all. Splices in underground wires must not be used.

Wires are conducted into signal cases through an iron conduit, and at the top of the case as shown in Fig. 395. Figs. 396, 397 show typical methods of taking track circuits through switches and crossovers. Fig. 398 shows the standard insulated rail joint. This is made in the railroad shops.

Signals are equipped with sheet iron number plates, to which enameled numbers and letters are attached. The numbers and letters must conform to the following specifications:

1. Plates shall be of sheet iron or mild steel, cut to size, with all roughness removed and sheared edges rounded.

2. Holes must be punched smooth.

3. The enamel must be sufficiently heavy to leave no part of the plate exposed.

4. Colors must be clear and figures sharply defined.

5. Enamel surface must be free from pits and imperfections.

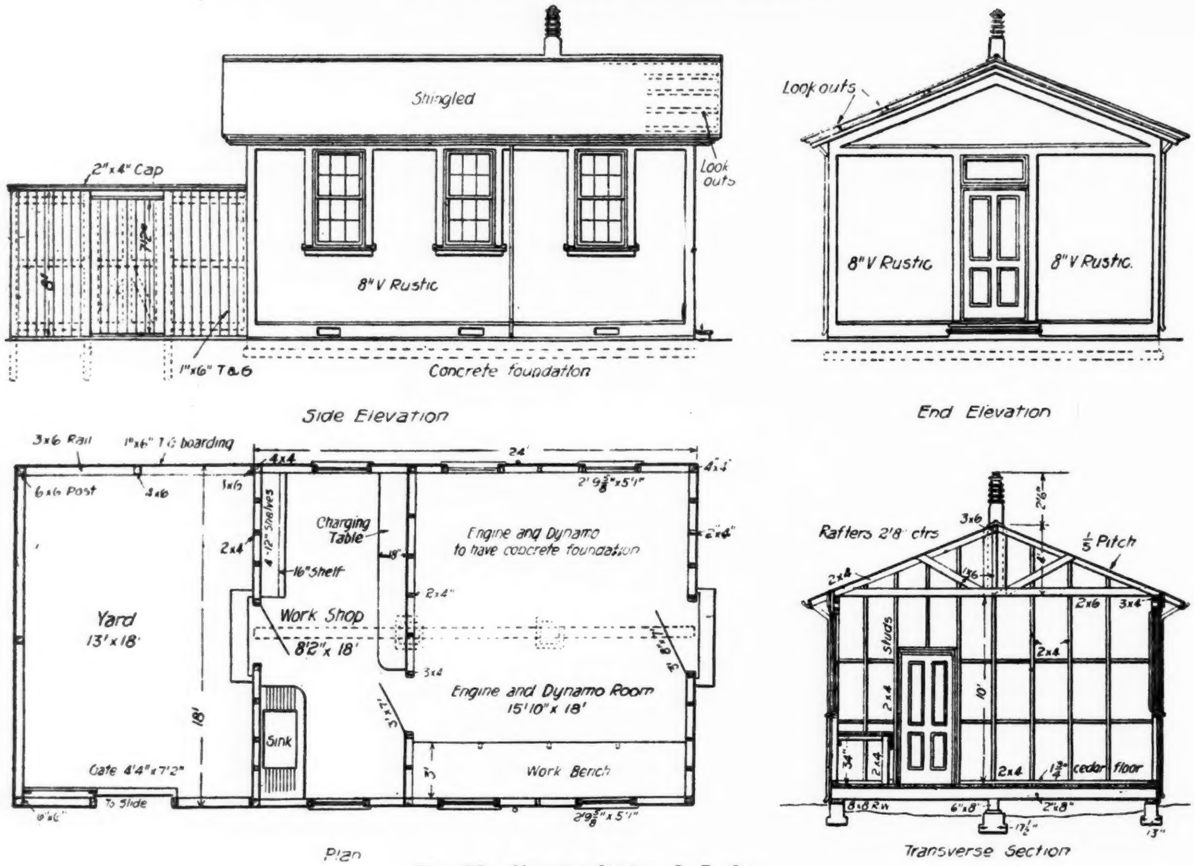


Fig. 403. Charging Station, S. P. Co.

Fig. 399 shows an iron relay box mounted on a wooden post. Wires from the pole line to the box are conducted in cable, as are also wires from the line to signals on the same side of the track as the pole line.

Fig. 400 shows a signal foundation layout on a fill. Fig. 401 is a clearance diagram, and Fig. 402 is a layout for signals at the entrance to a station.

The standard for painting signal poles is: First seven feet above the ground, black; balance of main post, bracket and upper post, white.

Fig. 403 shows the design for a standard battery charging station, for charging storage batteries.

Track relays are of 4 ohms resistance and line relays of 500 ohms. Relays are of the enclosed type meeting the R. S. A. specifications.

The following sizes and classes of wire are standard: For line, No. 9, B. W. G. galvanized iron; for bootlegs, No. 8, B. W. G. galvanized iron, or No. 6, B. & S. gage copper-clad steel; for leeds from track, No. 10, B. & S. gage rubber-covered copper, 5/64-in. wall; for leeds from line, No. 14, B. & S. gage rubber-covered copper, 5/64-in. wall; for leeds from battery, No. 10, B. & S. gage rubber-covered copper, 5/64-in. wall; in chutes, No. 12, B. & S. gage rubber-covered flexible copper, 5/64-in. wall.

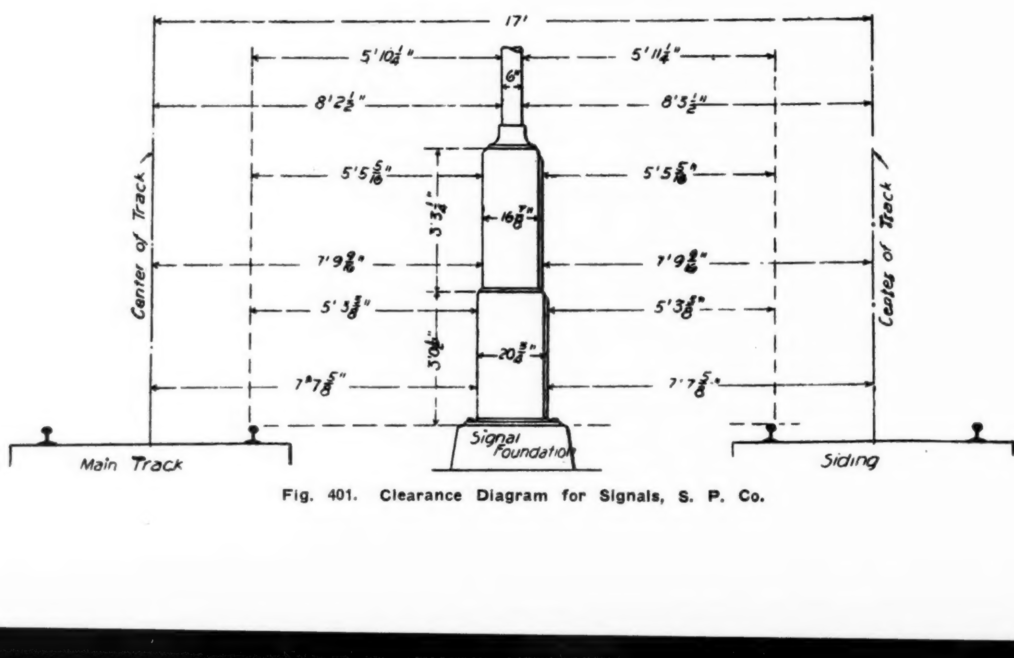


Fig. 401. Clearance Diagram for Signals, S. P. Co.

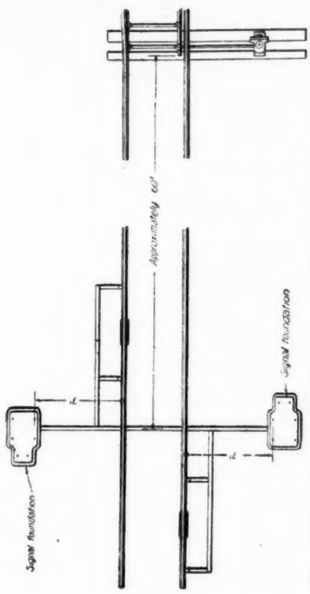


Fig. 402. Layout for Signals at Entrance to Station, S. P.

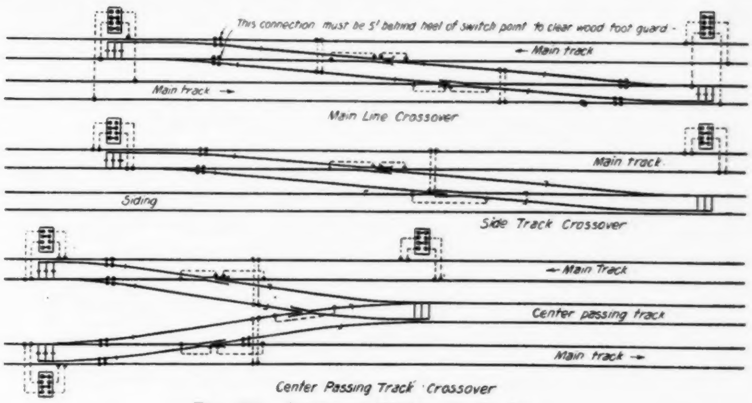


Fig. 397. Crossover Wiring, S. P. Co.

PORTABLE STORAGE BATTERIES FOR AUTOMATIC SIGNALS, HARRIMAN LINES.*

By A. H. McKeen, Signal Engineer, Oregon-Washington Railroad & Navigation Company.

The application of portable storage batteries to signal circuits on the Harriman Lines began in the year 1890 on the Western division of the Southern Pacific under the direction of W. W. Slater, then master of signals of that company. At the time there were no motor-operated signals on the Southern Pacific lines and the use of portable storage batteries was confined to operating highway crossing bells and indicator and locking circuits at hydro-pneumatic interlocking-plants. The type of battery then in use was crude, heavy, and of generous dimensions for its capacity. No charging plants were in service, and it was necessary to charge the batteries on an arc circuit carrying approximately 2,000 volts. It was found that a considerable saving was effected through the use of these portable storage cells as compared with the cost of operating the circuits with primary and gravity cells and with a view of extending the use of storage cells to several installations of single track electric automatic block signals that were contemplated, tests were carried on for several years with various types of portable storage batteries on the market. The results of these tests were so satisfactory that in 1899 and 1901 when these several installations of automatic signals were completed, the experimental stage had been passed and portable storage cells were decided on as being the least expensive and most satisfactory source of energy for operating the motor circuits.

Gravity batteries were used for the line and track circuits, although later on, the gravity line batteries were dispensed with and the storage battery served the double purpose of operating both line and motor circuits. Each of the above-mentioned signal installations consisted of approximately 20 miles single track. At the foremen's headquarters of each installation a charging outfit, consisting of a two horse-power gasoline engine, belt connected to a 1-kilowatt generator was installed; the foreman attended to the work of charging and inspecting the batteries, and distributing them to the nearest stations on local passenger trains. From this small beginning, the operating officers of the associated lines, comprising the Harriman System, recognized the advantages of automatic signaling as a means of facilitating and safeguarding traffic, with the result that each year, additional mileage of automatic signals was authorized, the amount of such mileage usually being the maximum that could be installed by the signal departments of the various lines during the year.

The methods of transportation to and from the charging plants vary with local conditions. On portions of the line where local passenger service is available, the batteries are loaded into the baggage car and distributed at each station by the batteryman, who accompanies the batteries. From the stations they are taken to the various battery locations by the maintainer on a velocipede or motor car, the discharged batteries being returned in the same manner to the station, where they are picked up by the batterymen and brought back to the charging plant on the return train in the evening. On other sections of the line the batteries are loaded into a specially arranged battery car and handled on local freight trains, stops being made at each battery location, where the batteries are changed by the batteryman and the maintainer on that district. The car containing the discharged batteries is sent back to the charging plant on the first freight train. Another arrangement consists of a charging plant built in a box car, which car is moved on the daily way freight and is set out at each alternate station; the batteries being changed out in each direction from the station by the maintainer. This charging car is fitted up in three compartments; in one end of the car is located the gasoline engine, generator, switchboard, and cooling tank. A large gasoline tank holding sufficient gasoline for one month's supply is suspended under the body of the car. The center part of the car is used as a battery room and is suitably fitted up with a battery bench, lead-lined sink and a large water tank for battery washing purposes. The other end of the car is arranged as living quarters for the batteryman. The car is equipped with heavy draught gear in order to avoid any damage due to rough handling while in transit. During the three years that this portable arrangement has been in service, it has given the best of results, handling on one district 832 cells monthly on a territory of 150 miles of single track signals. An important advantage in this method is that on the 150-mile district referred to, only 80 extra cells are required for changing out purposes; this being only 10 per cent of the total number of cells in service on the district.

On the Harriman Lines there are 52 charging plants, each of which (except the portable plants) is located at the headquarters of the assistant supervisor, where a shop building

*Extracts from a paper read before the Railway Signal Association, March 20, 1911.

is provided, and part of this shop building is used to house the charging machinery, hence no special building is necessary. The average territory covered by each plant is 104 miles. Whenever current can be obtained from local power companies, a mercury arc rectifier or motor generator set is installed and at other locations where electric power is not available, a gasoline engine and generator charging outfit is used. Each charging plant is in charge of a special batteryman, whose duties consist of charging, inspecting and cleaning the batteries and assisting the maintainers in changing out the cells on their districts. All cells are returned to the plant monthly and are thoroughly inspected and cleaned before being put on the charging circuit. A record is kept in a book, provided for the purpose, of the voltage, specific gravity and condition of each cell on arrival at the plant and each cell is examined for short circuits or other faults; the hard rubber covers and connectors are cleaned and sediment removed if necessary. Once a year the old electrolyte is replaced with new in order to discard all impurities held in solution.

In the case of stationary batteries it is the usual practice to give an overcharge several times a month, the overcharge having the effect of driving the sulphate out of the plates and keeping them in a healthy condition. Portable cells which are charged once a month only, are subject to considerable sulphating and therefore require a long charge to bring them up to capacity. It is the practice to continue the charge for two or three hours after the voltage and specific gravity has ceased to rise. The uniform gassing of all cells on charge is a good indication of their condition and the failure of any cell to gas is investigated before the charge is continued. During the charge voltage and specific gravity readings are taken and recorded in the book and any cells not coming up to the proper voltage and gravity are closely watched and given special treatment if necessary. Maintainers are required to make weekly inspection of all cells in service, examining them for loose connections, taking voltage readings and replacing any evaporation of electrolyte that may occur during the time the cells are in service. In replacing the evaporation only water whose purity has been previously passed on is used. In localities where pure water is not obtainable, distilled water is provided.

For the guidance of signal department employees the following instructions relative to the care of portable storage cells are printed in the book of rules and regulations of the maintenance of way department:

Assembly and Putting Into Commission.

After unpacking and before assembling the parts, carefully remove from them all packing material or other foreign substance, and make an examination for broken lugs or plates. Also examine the rubber jars for cracks or holes made by nails improperly driven into the packing case. Assemble the cell by placing between each positive and negative plate one each of the perforated hard rubber and treated wood separators, the former adjacent to the positive plates. The smooth side should be placed against the negative plate. After slipping the assembled element into the hard rubber jar, fill with electrolyte of 1.210 specific gravity to a point about one-fourth inch below the cover, and allow the cell to stand in this condition for from six to 12 hours before beginning charge. No harm will be done by allowing it to stand as much as 24 hours, but this is unnecessary. During the standing period and throughout the charge the height of the electrolyte should be watched (some of the electrolyte is absorbed by the plates and separators) and kept well above the top of the plates and separators by adding 1.210 electrolyte, but not so high that it will overflow when gassing starts.

Charging should be commenced at the rate of five amperes, and this rate should be maintained throughout the entire length of the initial charge. In fact, it will be found a very practical and convenient rate for charging either new or old cells at all times.

As the initial charge progresses, the cells should be watched closely for the first few hours, and any cell developing a tendency to rise in temperature should receive special attention. If the cell continues to rise until a temperature of 100 degrees Fahrenheit seems liable to be reached, it should be cut out of circuit, to be examined for internal short circuit or faulty connection. It rarely occurs that a cell will show such tendency to rise in temperature, and in such cases the cause is usually apparent upon examination.

The initial charge should be of 40 to 50 hours' duration, not necessarily continuous, but such that the total amount of current delivered to the battery shall be approximately 200 ampere hours.

Note carefully, however, that the mere fact that a cell has received 200 ampere hours' charge is not to be taken as proof that it is in fit condition for service. From the time the initial charge is first begun, a complete record of each cell should be kept, particularly as to voltage, temperature and specific gravity, in a manner to be more fully described later, and this record should be the basis upon which the condition of the cell is determined. After 200 ampere hours' charge, a new cell will register approximately 2.55 volts and specific gravity of electrolyte will stand at 1.300 or perhaps a little less. All cells approaching these figures at that time may be considered ready for service. Never on any account begin charging with specific gravity above 1.300.

Ordinary Recharging.

In charges subsequent to the initial charge, the general rule is that the amount of current put into the cell should be twice the amount delivered by the cell during the 30 or less days elapsing since the next previous charge. Under normal conditions and service, the amount of current required of a cell will vary from 45 to 75 ampere hours per month; and the amount of current the cell should receive on recharge will correspondingly vary between 80 and 150 ampere hours. In this connection it should be borne in mind that while the type SS-7 cell has a capacity of only 51 ampere hours at its normal discharge rate, the capacity developed through a discharge extending over a period of 30 days may be as high as 100 ampere hours.

On account of the nature of the service, however, it cannot be known definitely just what amount of current has been delivered from the battery during the month, and it becomes necessary to determine just how many hours the battery shall be charged entirely from voltage and specific gravity readings taken during the progress of the charge.

Just before the cell is placed on charge the voltage and specific gravity should be taken and recorded, and during the progress of the charge similar reading recorded, taken at intervals of about three hours. It will be found that both voltage and specific gravity will gradually rise until a point is reached where charging for two or three hours fails to raise either. Then and not until then is the cell fully charged. The maximum voltage at this time will vary for cells of different ages, although constant for any particular cell over a period of several months, but the specific gravity of the electrolyte at this point should always be adjusted, if below 1.270, to 1.300 for cells of all ages. It will be found that if cells have not received good care in the past and acid has been added unnecessarily, that the specific gravity will continue to rise greatly above 1.300. This indicates excessive sulphation of the plates, and in such cases the electrolyte should be successively reduced by dilution with pure water, the charge continuing uninterruptedly, until the cell no longer exhibits a tendency to exceed that point. It rarely occurs that a cell will fail to rise to 1.270.

but in case the cell fails to show any rise during the period of six hours' charging, it should be taken off charge and discharged at about 10 amperes to a voltage of 1.5 volts. The electrolyte, which will then register probably about 1.150 or less, should be replaced with new electrolyte of 1.170 specific gravity and the cell recharged. The usual source of such trouble is in the electrolyte having been spilled from the cell while out on the road and replaced with water. Replacement for ordinary evaporation should be made with pure water only, but in replacement for acid spilled of course a certain amount of electrolyte must be used.

Each month, as the cells are returned to the charging station, they should be superficially examined for damaged parts, and the outside of wood cases and tops of rubber jars thoroughly washed. The terminals should receive special attention and all corrosion thoroughly cleaned off and a wipe of vaseline applied. All connectors should be taken apart and rinsed well in bi-carbonate of soda, then in water and finally, when dry, dipped in some light mineral oil. It is important that corrosion be not allowed to accumulate on terminals and connections where it is almost certain to find its way into the cell.

Special Treatment.

Once in six months each cell should be taken apart and closely examined for damaged or defective parts. The sediment should be cleaned from bottom of jar and the plates lightly washed before being replaced. The same electrolyte may be used again. The principal object of this examination is to discover any cell which should be discarded as too old or too much worn to continue in service for another six months, the determination in this case being based principally upon the mechanical condition of the plates with regard to the amount of active material that has been lost out of them. A system of record should be adopted to insure that all cells receive the examination.

Once each year, the cell, after being charged in the ordinary manner, should be discharged at a rate of 10 amperes to 1.5 volts and a record kept of the ampere-hour capacity of the cell as thus developed. The old electrolyte at this time also should be thrown away and immediately replaced with new electrolyte of the same specific gravity. This is done in order to discard all impurities held in solution in the electrolyte, as it has been found that after a year's work in this service the electrolyte is almost certain to contain a greater or less amount of such impurity. This discharge and subsequent charge are important in more ways than one, and should not be neglected, in that they give a reliable estimate of the value and condition of the cell. Sometimes a cell which has become so badly sulphated as to appear worthless, and one which no amount of continuous charging seems to affect in the least favorably, will be again brought up to first-class condition merely by charging and discharging a few times. If a cell fails to register 40 ampere-hours or more on the first discharge, it should be charged and discharged a second time, and if necessary this process repeated until the requisite capacity is developed or the cell discarded as worthless. If the cell registers 40 or more ampere-hours' capacity on the first charge, a subsequent charge of 25 or 30 hours at five amperes will place it in condition for service.

Cells temporarily out of service should be kept in a fully charged condition by being given a freshening charge of 4 or 5 hours' duration twice per month. If it is not convenient to give them this freshening charge, they should be placed entirely out of commission in the following manner: First, give them a full charge, then remove the plates from the electrolyte and place the negatives and positives separately in water for about one hour to remove all acid. After draining and drying, the positives are ready to store away. If the negatives in drying become hot enough to steam, they should be rinsed or sprinkled with water a second time. When dry, completely immerse the negatives and allow them to stand for three or four hours in electrolyte of about 1.210 specific gravity. After washing and drying as before, they are ready to be stored away. Rubber separators should be rinsed in water and saved, but the wood separators are not worth saving unless comparatively new and in good condition. If saved, they should be kept immersed in water or weak electrolyte. In putting such cells into commission again, treat them as entirely new cells, being governed by the rules relating to placing new cells into commission.

The batteries are arranged four cells to a set, each set being assembled in a wooden carrying case with wood separators between the jars. The weight including the case is approximately 56 pounds per set. On some divisions the jars are set in compound in the carrying case and the tops of the cells sealed, although the majority of the signal supervisors favor having the jars and covers unsealed in order to facilitate inspection of the cells. Where cells are not sealed the rubber covers are fitted with soft rubber lipped edges, which fit snugly to the sides of the jar and prevent sloppage of electrolyte. The cell terminals consist of a No. 6 copper wire cast into a projecting three inches above the pillar post on both positive and negative groups. The connections between cells are made with a brass battery connector.

The variety of temperatures experienced on different parts of the system has no apparent effect on the batteries and therefore no spcial housing is necessary to protect them from extremely cold or hot weather. On parts of the line through Idaho, Utah, and Nevada the temperature frequently goes as low as 30 degrees below zero, yet no trouble is experienced from electrolyte freezing or batteries failing to operate the signals the required 30 days. During the hot summer months it is necessary to replace the evaporation of electrolyte occasionally.

The batteries are housed in the lower case of the signal which makes them easily accessible for inspection. The lower signal case also serves to accommodate the track and line relays. At the end of sidings on single track or other locations where two signals are opposite each other, one set of batteries is used to operate both signals and after the batteries have been in service fifteen days, the maintainer interchanges them with the batteries at the distant signal, this having the effect of equalizing the discharge to a considerable extent on all cells in service and avoids the necessity of charging cells for different lengths of time on their return to the charging plant and also eliminates the possibility of cells being discharged to a point that might result in a signal failure. During the first six months of 1910 there were a total of only 61 signal failures due to weak, dead or defective storage batteries and only 13 failures from poor or broken connections on storage batteries, or a total of 74 failures from such causes on the entire system, which was less than five per cent of the total number of failures from all causes. The total number of signal movements during the same period was 48,758,000, and the number of movements per failure from storage battery causes amounted to 659,000, which is no doubt a more creditable showing than would be possible if primary batteries were used. In addition to the reliability of operation thus secured, the economical advantages of the portable storage battery over the primary battery, both for installation and maintenance, is an important consideration.

Cost of Storage Cells.

1 cell SS-7 storage battery, complete	$4.85
2 battery connectors, @ 8c each	.16
Electrolyte	.03
Freight charges	.30
Total cost	$5.34

Cost of charging machinery and apparatus in 52 plants, @ $450 each	$ 23,400.00
Cost of 48,516 storage cells, complete, including freight charges	259,075.44
Cost of 12,129 carrying cases, @ $2.60 each	31,535.40
Total cost	$314,010.84

Cost of Primary Cell.

1 350-ampere-hour primary cell, complete	$2.00
Freight charges	.20
Total cost	$2.20
Cost of 178,480 primary cells, complete, including freight charges	$392,656.00
Cost of 9,026 concrete battery wells, @ $25 each	225,650.00
Freight charges on 9,026 concrete battery wells, each weighing 1,600 pounds, @ $20 each	180,520.00
Charges for work train and locomotive crane or derrick with crew for unloading and placing 9,026 battery wells, 90 days @ $50 per day (estimated)	4,500.00
Cost of labor for digging holes and setting 9,026 battery wells, @ $10 per well (estimated)	90,260.00
Total cost	$893,586.00

Cost of Maintenance of Storage Cells Per Year.

Interest on investment of $314,010.84, @ 5%	$ 15,700.54
Depreciation on 52 charging plants costing $23,400, at 10%	2,340.00
Depreciation on 48,516 positive groups, costing $1.57 each, @ 22%	16,757.43
Depreciation on 48,516 negative groups, costing $1.835 each, @ 25%	22,256.71
Depreciation on 12,129 carrying cases, costing $2.60 each, @ 10%	3,153.54
Cost of renewals of broken jars, covers and separators on 48,516 cells, at 9 cents per cell per year	4,366.44
Cost of electrolyte renewals on 48,516 cells, @ 3 cents per cell per year	1,455.48
Cost of current, gasoline, oil, etc., at charging plants per year, @ 18 cents per cell	8,732.88
Total cost	$ 74,763.02

Cost of Maintenance of Primary Batteries, Per Year.

Interest on investment of $893,586 @ 5%	$ 44,679.30
Cost of renewals for 178,480 cells per year, at $1 each	178,480.00
Cost of renewals of broken jars and covers on 178,480 cells per year, @ 7 cents per cell per year	12,493.60
Total cost	$235,652.90

Wtih reasonable care, the average life of SS-7 portable cells and their component parts are found to be as follows:

Positive elements	4½ years
Negative elements	4 years
Rubber jars	10 years
Rubber covers	10 years
Rubber separators	10 years
Wood separators	2 years
Carrying cases	10 years

No charges are made for transporting storage batteries either when handled on passenger or freight trains and even though a nominal charge should be assessed, the amount would not exceed the freight charges over foreign lines for renewals for primary batteries. This item is therefore not included in the foregoing cost of maintenance of storage or primary batteries, neither is the expense for labor for charging, inspecting and changing out storage cells or making renewals to primary cells taken into consideration, for the reason that so far as it can be ascertained from Western roads using primary battery, the cost for labor for maintaining primary batteries is practically the same as with portable storage battery. The batteryman looks after the charging of the storage batteries on a district averaging 104 miles, the maintainers assisting in distributing the batteries, which requires on an average two days' time of each maintainer monthly. Maintainers' districts range from 14 to 20 miles according to the number of signals, local conditions, etc. The average district is approximately 16 miles with 32 signals. Maintainers have no helpers and are required to look after all work in connection with the maintenance of signals on their district including the care of signal lamps.

The prices as shown for both portable storage batteries and primary batteries are the regular list prices less the usual trade discount. The freight charges are figured on an average basis for the entire system and are reasonably accurate.

The cost for current for operating motor-generator sets or arc-rectifier plants varies from one-half cent to five cents per kilowatt and the cost for generating current with gasoline engine-generator sets is about ten cents per kilowatt. Taking an aveage for the entire system, the annual cost for charging current is 18c per cell.

The foregoing is intended to cover the conditions existing on the Harriman Lines only and is the result of the experience of 20 years with the use of portable storage batteries on those lines. The conditions on many Eastern roads are no doubt radically different. The item of freight charges on material which is purchased in the East or Middle West is a heavy expense for roads in the Far West, although even with the elimination of these charges from the cost of installation and maintenance, the results under the operating conditions in the Far West, would still leave a substantial difference in favor of the portable storage battery installation.

The bridge which the Philadelphia & Reading contemplates constructing over the Delaware river at Yardley, Pa., to replace the present wrought iron structure, will be double track, 1,256 ft. long, and will consist of 14 arches, twelve of which will be 90 ft. long, and two of which will be 83 ft. in length. The height from the water level to the crown of the arches will be 65 ft. The new bridge will cost about $400,000.

The Southern Pacific is preparing plans for the construction of a 187-ft. single-leaf double-track bridge at San Pedro, Cal.

The Missouri, Kansas & Texas will join the city in the construction of a steel viaduct over its tracks at Denison, Tex. The estimated cost of the structure is $30,000.

Electric Railway Block Signaling.

The United Railways & Electric Company of Baltimore has had the Kinsman Block System installed on a section of its Gilford Avenue Line. This is a double track elevated railway which runs for a considerable distance above the tracks of the Pennsylvania Railroad where steam locomotives are continually drilling cars from the Pleasant Street freight and passenger stations. The elevated structure includes long spans over Pleasant Street, Centre Street and Madison Street. There are stations located at the end of the spans over the streets mentioned.

The cars are frequently enveloped in smoke and steam caused by the locomotives which run underneath the structure. The signals are required to protect cars under this condition, to protect the cars standing at stations, and to keep cars evenly spaced.

The track plan, Fig. 1, shows the portion of the track which is protected by signals. This protection extends from south of the Centre Street span to north of the Madison Street span. The portion of the track south of Centre Street, which is not protected, is free from the annoyance of steam and smoke so that signal protection is not required at present.

Fig. 2 shows the circuit used for the wiring of these signals. In this system there is only one line wire between signal stations required. Edison B. S. Co. No. 4 cell with low temperature electrolyte is used for the operation of the relays in the track circuit. These relays are the standard D. C. relay used in steam road practice, except that they are wound to two ohms per pair of spools and are adjusted differently.

All the wiring to the track and to the top of the signal poles is carried in loricated conduit, and cordulets are used

at all outlets and bends. High grade wire and the best of material have been used throughout this installation. The circuits are so designed that in case of failure of the mechanism or derangement of the wires one of the following conditions results:

1. The signal will immediately operate to the "Stop" position and remain in that position until repairs are made.
2. The signal will not operate to give the "Proceed" indication to allow a car to enter the block.
3. The signal will operate normally, allowing the first car to enter the block and then operate to the "Stop" position and remain in that position.

A failure of the signal to operate or no light in the signal is understood to be a "Danger" indication.

Circuit for the Operation of Signals—Fig. 2.

The semaphore of this signal is secured to the shaft which is operated by the rotary armature of magnet A, and is held normally in the vertical or "Clear" position. In the front of the signal case there is a hole back of which is a spectacle carrying the three glasses colored green, orange, and red. Immediately back of the spectacle is an electric lamp. The spectacle is secured to the shaft which operates the semaphore. The colored glasses are used as a screen before the lamp to give the proper light indication corresponding to the semaphore.

When the circuit of the operating magnet A is opened, the semaphore falls by gravity. There is a slot magnet B, which holds the signal in the forty-five degree, or "Caution", position.

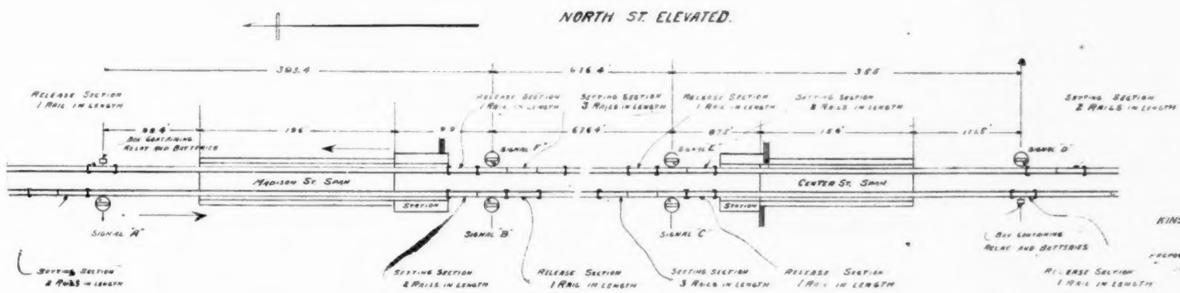


Fig. 1. Diagram Showing Arrangement and Operation of Signals.

This magnet has an armature which is operated against the tension of the spring. There is a pin attached to the armature which is used as a stop for the signal. When this magnet is energized the pin is thrust forward so that, as the signal falls by gravity, the pin engages a lug on the spectacle, and the signal is stopped and held in the "Caution" position. If the circuit for the magnet A is opened and magnet B is not energized, the semaphore will fall by gravity to the horizontal, or "Stop" position.

There are two sections of the traffic rail used in the track circuit. These two rails are insulated by the use of three insulated rail joints. In between the traffic rails relayer rails are used as shown. These rails are bonded together, and are bonded to the traffic rails so as to carry the return propulsion current around the insulated sections. It might be preferable, instead of using the relayer rails, to cross bond on each side of the insulated sections, or a long copper cable could be bonded to the traffic rails at the insulated joints. The insulated section, to which relay S is connected, is the setting section, and the section to which the relay R is connected is the release section.

Description of Operation of Signals as Shown on Fig. 1.

Signal "A" protects the block or section of track between Signal A and Signal B; Signal B protects the section of track between Signal B and Signal C; Signal C protects the section of track between Signal C and the pole immediately opposite Signal D. The north-bound track is laid out similarly.

These signals are operated by track circuits. At the entrance end of the block there is a setting section and at the exit end of the block there is a release section. When a block is not occupied the signal is in the vertical or "Clear" position, and as the car approaches Signal A it runs onto the setting section. This causes Signal A to operate from the "Clear" position to the forty-five degree or "Caution" position, and this operation of the signal is the indication to the motorman to proceed on through the block. As the rear of the car passes off the setting section at Station A, the signal operates to the "Stop" position and remains in this position until the car passes over the release section located at Signal B. This causes Signal A to operate from the "Stop" to the "Clear" position.

As the car approaches Signal B it runs upon the setting section of Signal B and causes that signal to operate from the "Clear" to the "Caution" position, and as the car passes off of the setting section at Signal B, the signal operates from the "Caution" position to the "Stop" position and remains in this position until the car passes over the release section at Signal C, which causes Signal B to operate to the "Clear" position.

As a car approaches Signal A when the block is occupied the signal is in the "Stop" position. The approaching car may run as far as the signal and stop on the setting section until the block is cleared. When the car that is in the block passes over the releasing section at Signal B, Signal A will operate to the "Clear" position for the length of time the car is passing over this release section. The signal will then operate from "Clear" to "Caution," which will be the indication to the motorman on the car which is waiting at Signal A to proceed.

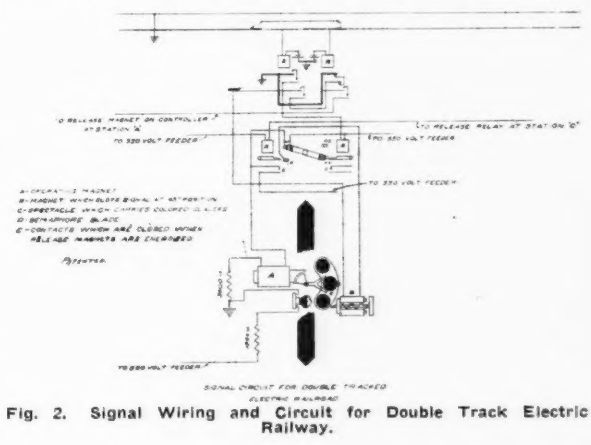


Fig. 2. Signal Wiring and Circuit for Double Track Electric Railway.

The relays S and R are the standard type of relay used on steam roads and are manufactured by one of the larger signal companies. The relays are operated by caustic soda batteries of the Edison B. S. Co. type. There are two batteries connected in parallel. One of the poles of the battery is connected to ground, and the other pole is connected to the setting and release relays as shown.

As the car passes into the setting section, current passes from the battery through the setting relay to the setting rail, through the wheels of the car to the grounded rails and back to the battery. This operates the setting relay. When the setting relay operates, current passes from the 550-volt section, the setting relay is operated and this energizes the setting magnet on the controller, causing the swinging arm to break contact with the short segment and make contact with the long segment. As the swinging arm breaks contact with the short segment the circuit to the magnet A is opened and allows the semaphore to fall from the "Clear" position by gravity. There is also the following circuit completed through the slot magnet: current passes from the 550-volt feeder, through the swinging arm on the controller, through the long segment, through the slot magnet, through the two front contacts in series and the setting relay, and through two back contacts in series on the release relay to ground. This energizes the slot magnet "B", and causes the semaphore to stop and remain in the 45 degree or "Caution" position for the length of time that the car is on the setting section. As the car passes onto the release section the release relay is operated, and this opens the circuit of the slot magnet "B", allowing the signal to fall by gravity from the "Caution" to the "Stop" position. In some locations, as for instance at Signal A on the drawing, Fig. 1, there is only the setting circuit located at the signal. In a case like this the circuit for the slot magnet would be through the two front contacts (in series) of the setting relay and directly to ground, instead of passing through the back contacts on the release relay and to ground.

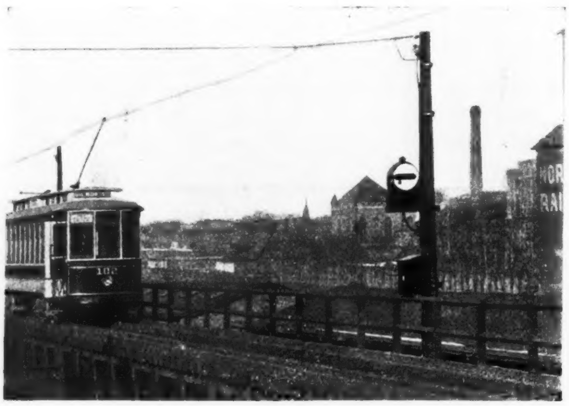
After the car has passed through the block, it passes over the release section which is located at Signal C, operates the feeder through the setting magnet on the controller and through two front contacts in series on the setting relay to the ground. This operates the setting magnet on the controller. When a car passes onto the release section, the release relay is operated and in the same manner operates the release magnets on the controller at the signal which is located one station in the rear, or in this instance at Signal A.

The controller is a step-by-step mechanism, which is operated by two magnets; the one marked "S" is the setting magnet, and the one marked "R" is the release magnet. Each operation of the setting magnet operates the controller one step from its normal position and each operation of the release magnet operates the controller one step back toward its normal position.

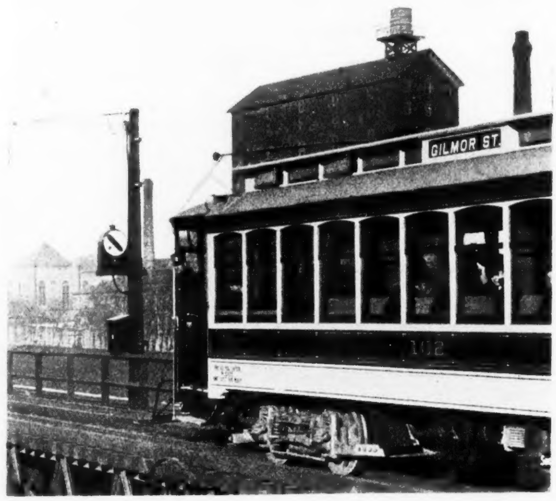
There are two swinging arms secured to the shaft of the controller and insulated therefrom. In the normal position these swinging arms are in contact with the short segments shown on the drawing. When the setting magnet of the controller is operated, the swinging arms are moved so that they break contact with the short segments and make contact with the long segments. Should the setting magnet of the controller be energized a second time, the swinging arms would be moved one step further from their normal position, and would still make contact with the long segments.

Each operation of the release magnet operates the controller back one step at a time and the swinging arms continue to make contact with the long segments until the last operation of the controller, which restores it to the normal position as shown. The contacts "E", which are underneath the release magnet, are normally open, but make contact while the release magnet is energized.

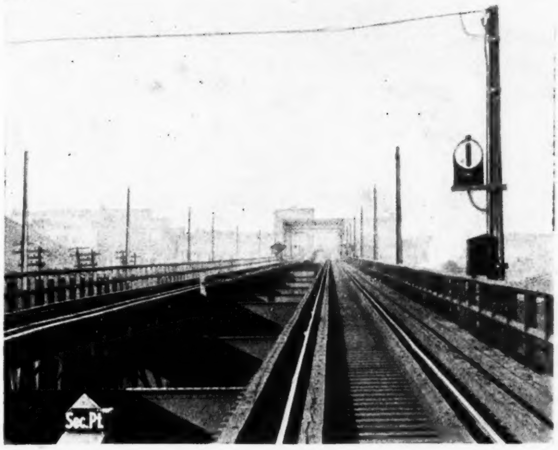
In the normal position of the signal the current flows from the 550-volt feeder, through the upper swinging arm on the controller, through the short segment, through the operating magnet A, and through 3,400 ohms resistance to ground. As the car approaches the signal and passes onto the setting release relay which is located at Signal C, and completes the following circuit: current passes from 550-volt feeder at Signal B through the release magnet on the controller at Signal B, through the line wire to Signal C, and through two front contacts in series on the release relay at Signal C to ground. This energizes the release magnet on the controller, restores the controller at Signal B to its normal position, and completes the circuit through the operating magnet A which causes the signal to operate from the "Stop" to the "Clear" or normal position as shown on the drawing. When a car is in the block the controller has been operated one step from its normal position and the Signal B is in the "Stop" position. A second car may approach the signal and stop on the setting section. This would cause the controller



United Railways & Electric Co., Signal at "Stop" Indication.



United Railways & Electric Co., Signal Indicating "Proceed."



United Railways & Electric Co., Signal in Clear Position.

to operate a second step from the normal position, but would not change the signals until the car that is in the block had passed over the release section at Signal C. When the car passes onto the release section at Signal C it causes the signal B to operate from the "Stop" to the "Clear" position for the length of time that the car is passing over this section. When the car is on the release section at Signal C, the release magnet at Signal C is operated and energizes the release magnet on the controller at Signal B, operating the controller one step back toward the normal position.

While the release magnet at Signal B is energized, the contacts E (shown underneath the release magnet) are closed, completing the following circuit: current passes from the 550-volt feeder through the contacts E, through the operating magnet A and through 3,400 ohms resistance to ground. As the car passes off the release section at Signal C, the release magnet at Signal B becomes de-energized and the contacts E are opened. This de-energizes Magnet A allowing the signal to fall by gravity, but as the car which is waiting at Signal B is on the setting section, the circuit through the slot magnet B as described above is closed and the semaphore falls to the "Caution" position. This latter operation of the signal is the indication to the motorman who is waiting at Signal B to proceed, and as he passes onto the release section and off the setting section at Signal B, the slot Magnet B is de-energized and the signal falls by gravity to the "Stop" position. After this second car passes over the release section at Signal C, the controller and signal are restored to the normal position as described above. The current passes continually through the lamp resistance and lamp. When the signal is in the "Clear" position there is a green light shown; when it is in the "Caution" position there is an orange light shown; and when it is in the "Stop" position there is a red light shown. The lamp used is a mirrored back reflector lamp.

The system of signals described herewith was installed by Kinsman Block System Co., of New York, and was put in service Dec. 25, 1910. This installation does not afford protection for reverse movements of trains.

The Maintenance of Way Department

SQUARE OR BROKEN JOINTS ON TANGENTS.

Practically all railroads are using broken joints on curves. This includes roads which lay tangents with square joints.

There are two important reasons for this standard. Unless rails are to be laid on very sharp curves, they are not previously bent. The tendency of an unbent rail in the track is to assume its natural or straight position. By putting the joint on one side opposite the center of the rail on the opposite side, we obtain conflicting tendences. The joint tends to elbow towards the outside of the curve, but the rail center across from it tends to draw towards the inside of the curve. As long as the rails are held by the track fastenings, the curve will be held approximately in line. In this case the track ties and fastenings are subjected to an extra strain on account of the broken joints.

If the joints were laid opposite, the tendency of both rails at the joint would be to elbow outward. The combined effect would cause the ties to move transversely and leave an elbow at the joint. The sharper the curve, the greater would be this defect in alignment.

The inside rail of a curve is shorter than the outside rail, and the difference in the length of these two rails varies with the degree of curvature. In order to have square joints on a curve, the inside and outside rails would have to be of different lengths, and such differences would not be the same for curves of different degree. It is impossible then to lay curves with square joints and use one standard length rail, and it is undesirable in that the correct alignment is much harder to maintain—[Editor].

Editor, Railway Engineering:

Replying to your favor of March 20 and question regarding square or broken joints: It depends altogether upon the condition of the road-bed and the condition in which track is desired kept. If a road-bed is well settled and sufficient material is furnished and force permitted to keep track up in good condition, I prefer the broken joint on tangents, otherwise the square joints will make a better riding track on tangents with less liability of derailments due to defects from various local causes, the principal one being lack of sufficient ballast with which to maintain good smooth track.

The only advantage of broken joints, in the writer's opinion, is that in the event of track creeping, ties can be squared around and kept at right angle with track, whereas with the square joints, one side of track usually, if not always, creeps more than the other, causing ties to become sloughed, thereby badly affecting gauge and line as well as surface, the three most essential features of good track next to drainage; the joint, of course, is conceded by most everyone to be the weakest portion of track. By using square joints the depression, if there is any, is in only one place, as against two with broken joints, in the same distance of 30 ft. or 33 ft., whichever the length of the rail might be; thus the depressions are distributed in a shorter space and being in two different places as against one cause a rocking, swinging motion of cars which is more apt to cause derailments than the up and down motion produced by low joints where laid opposite each other.

There is no doubt that the best results have been produced from track laid with broken joints in as much as it is the most universal and modern method employed, and I am merely giving you my individual opinion—the sum and substance being that where track is well maintained broken joints are the best, and where conditions and circumstances are such that it cannot be done the square joints are the best.

I prefer the plain four hole suspended joint angle bar with base plates, they being more simple to apply and remove and answer the purpose intended, as well, if not better, than any others I have observed or have had any experience with.

Roadmaster, Great Northern Ry.

Editor, Railway Engineering:

Replying to your letter of March 20 in regard to broken and square joints on tangents, I prefer the square joints, particularly on poorly ballasted track, as I have found it easier to make track ride passably well with square joints; broken joints make a worse riding track, on account of there being really twice as many, as where the joints are square. On a well ballasted track, where you have a reasonable amount of labor, I think the broken joint is as good to say the least, as the square, and for some reasons I think it is better, chiefly because the track can be kept in line easier.

I prefer a four-hole angle bar, but do not consider a four-hole or six-hole as good for medium weight of rail, say for 72 or 85-lb., as a combined joint with base plate, similar to the Weber, for example. I have had better success keeping track in good shape with the Weber joint than any other kind I have ever used.

Roadmaster, Boston & Maine R. R.

Editor, Railway Engineering:

I prefer broken joints on tangents to square joints, as the rails are easier laid and the joints are easier maintained.

As for angle bars, will say that I do not favor angle bars for this day and time, but if I was using angle bars, I would favor a six-hole angle bar to a four-hole angle bar. I advocate a continuous angle bar rather than a combination angle bar, and I do not think there is any joint that beats the continuous angle bar.

Roadmaster, Mobile & Ohio R. R.

Editor, Railway Engineering:

I prefer broken joints on all tracks. My reasons are that the track is easier maintained and makes better riding track, and track is not so likely to spread and the guage is easier maintained. I prefer a common angle bar with six holes and 30 ins. in length. This bar has more strength than a shorter bar and holds up the joint better. We have now some 24-in., 90-lb. continuous angle bars, with four holes in use which makes a very good joint. I believe that this joint is better and stronger than the common angle bar joint.

Supervisor, C., C., C. & St. L.

Editor, Railway Engineering:

I prefer broken joints on tangents as track is easiest maintained. With broken joints track keeps its line and surface better than with square joints. If broken joints are good for curves they must be good for tangents.

I prefer four-hole continuous angle bar and base plate so as to get all the strength possible near the end of the rail.

General Roadmaster, Duluth, Missabe & Northern Ry.

Editor, Railway Engineering:

I wish to state that I prefer broken joints on all tangents as well as on curves and by using broken joints, I feel that the track is easier to maintain.

As to the matter of angle bars, I prefer a four-hole bar, using a one-inch bolt and certainly do advocate the use of continuous angle bars as I find that it is easier to keep the track in line and surface.

Road Supervisor, Evansville & Terre Haute R. R.

Editor, Railway Engineering:

I prefer broken joints on tangents as compared with square joints for track stays in better line and in better surface; track bolts will not work loose as fast, which means quite a saving in the number of track bolts used for renewals as well as a better riding track with less noise coming from loose joints.

The number of bolts used in angle bars would reasonably depend on their length. We have used 38-in. angle bars with six bolts with very good results. This joint with six bolts will, I find, give better results than a shorter angle bar of same type with only four bolts; the 38-in. splice is a three-tie joint and six track bolts hold the expansion good; this is largely due to the fact that six bolts in the joint will not become loose as quickly as if only four bolts are used.

I am not in favor of a base plate used separate from the splice. I am, however, in favor of the continuous splice 25 ins. long; this splice is so constructed that it affords a base support and makes a first-class joint, affords good line and good surface, and gives no particular trouble with bolts becoming loose.

Roadmaster, Mich Cent. R. R.

Editor, Railway Engineering:

I believe that square joints on dirt track and even on ballasted track, where force is not sufficient to maintain track to a high standard of perfection, are the best. The advantage is in favor of the square joints in the item of maintenance, and where track is allowed to become rough the train is not put into a rocking motion with the square joints like it is with the broken joints.

I do not think there is anything gained by the use of the six-hole angle bars—think it is a useless waste of material. I am in favor of the combined continuous angle bar instead of the base plate and angle bars. I think the continuoues bar the best one that has been put on the market to date.

Roadmaster, C., R. I. & P.

RAILWAY CONSTRUCTION.

Contracts have been given to the W. E. Ule Construction Company, it is said, to build an interurban line from Houston, Texas, east to La Porte and Sylvan Beach, about 25 miles. A. F. Irwin, Houston, is right-of-way agent for the company.

Improvements along the line of the Atchison, Topeka and Santa Fe Railroad, involving the expenditure of large sums of money, are now in process of completion, and work on other additions to the facilities of the system, it is announced, will be begun within a short time. Installation of double track between Chicago and Kansas City will soon be finished, workmen now being employed on the last stretch of thirty miles between Rothville and Carrolton, Mo. Both tracks are ballasted, and a block signal system will be used throughout the entire distance. President Ripley of the Santa Fe, who has taken a special interest in this improvement, has been a persistent advocate of the two-track line from Chicago to the Missouri River, constructed as to carry the heaviest and fastest traffic with ease and safety. At Joliet, Ill., the Santa Fe is spending about $350,000 for a system of elevated tracks, and its share of the cost of a new union depot, while at fifteen stations on the Illinois and Missouri divisions of the line additional track facilities are being furnished. Announcement also is made that the viaducts at Twelfth and Eighteenth streets in Chicago are to be renewed, at a cost of $20,000 each. There will be a further expenditure soon of $15,000 to deepen the slip from the Santa Fe's Chicago elevator to the Chicago river, in order to accomodate large grain vessels. A coalhouse and sand chute are in course of construction at Corwith, Ill., the estimated outlay in this connection being $50,000. It is also understood the company now has under consideration a plan to build a new bridge over the Missouri River at Sibley, Mo. A new double-track bridge over the Grand

River is nearing completion, and represents an expenditure of $153,000.

It is reported that the Philadelphia & Western will build an extension from Villanova, Pa., to Norristown, and that a contract for the work has been given to the Stone & Webster Engineering Corporation, Boston, Mass. It is understood that the construction work will cost about $2,000,000.

The Missouri, Kansas & Texas Railroad will issue $25,000,000 in general improvement bonds for extensive doubling of tracks, straightening of lines and for bridges, and heavier steel. The company applied to the board of railway commissioners recently for authority to issue $107,000,000 in bonds, $82,000,000 of which will be used to take up outstanding debts and $25,000,000 for the proposed improvements and new trackage. The line from Kansas City and Parsons will be straightened until it is almost an air line and several new bridges and much new steel will be laid. From Parsons through Oklahoma, a complete double track will be laid. Nearly all of the $25,000,000 will be spent in Kansas and Oklahoma.

The Chicago, Milwaukee & Puget Sound is said to have given a contract to Bates & Rogers, contractors, of Chicago and Spokane, Wash., for building a tunnel in Spokane, to be used by the railway in entering the terminal building. The tunnel will cost about $600,000. Additional contracts for terminal work will be let within a few weeks.

The Birmingham & Northwestern Railway Co. has let the contract to J. W. Wright, Jr., of Union Springs, Ala., for 50 miles of construction from Jackson to Dyersburg, Tenn. Work will be begun at Jackson. There is approximately 500,000 cu. yds. of earthwork, but no rock; 100 acres of clearing, 3,300 linear ft. of trestles, 2,500 linear ft. of pipe, and a 70-ft. steel span, the latter across Forked Deer river.

The Crosbyton & South Plains recently began operating a line from Lubbock, Texas, east to Crosbyton, 40 miles. It is understood that work will be carried out on the proposed extension from Crosbyton to Spur, 35 miles. John A. Knox, chief engineer, Lubbock.

Work will be started soon for a completion of all connections on the new Twin-Cities Kansas City short line planned by the Rock Island system. To complete the line to Kansas City the Rock Island will build tracks south from Des Moines to Allerton, Iowa.

The Gulf & Rio Grande Construction Co. has filed its charter in Texas. The company proposes to build a railroad from Aransas Pass to Eagle Pass, Texas, more than 200 miles, running through almost the entire length of the Nueces Valley. The incorporators are: A. W. Lilliendahl, Saltillo, Mexico; B. H. Valentine, Brooklyn, N. Y.; Robert P. Coon and Albert Tolle of San Antonio, Tex., and Lee Frisbee of Beeville, Tex. Capital, $100,000.

According to reports, the extension of the Nevada-California-Oregon from Alturas, Cal., north, will be built along the east side of Goose lake to Lakeview, Ore., this coming summer. Grading has been finished to within a few miles of Davis, Cal.

The Grand Trunk is making arrangements for the construction of an 86½-ft. single-leaf bascule bridge over the Trent canal at Peterborough, Ont.

The Boston & Maine has awarded the contract for its Bellows Falls bridge, which will require about 1,200 tons of material, to the Boston Bridge Co. This road is still in the market for a number of bridges which it is estimated will aggregate about 10,000 tons.

The Grand Trunk Pacific Railroad is preparing to erect a bridge on the Battleford and Wainwright branch near Battleford, Sask.

New Literature

The O. F. Jordan Company, McCormick Bldg., Chicago, has recently issued a neat catalogue describing the Jordan Spreader. This spreader is adapted to work on either or both sides of the track and to spread heavy clay material as well as lighter materials including snow. There are several illustrations in the book showing various views of the machine at work performing various operations.

* * *

Frog Bulletin number one has been issued by the Continuous Frog and Crossing Company, of St. Louis. The catalogue is distinctive in style, and has a large number of excellent illustrations. The type is clear and well arranged, the descriptions are terse and to the point, and the book has a neat and attractive appearance.

* * *

The Corrugated Bar Company, Chicago, has issued a catalogue entitled "Getting It There On Time." This pamphlet describes, with illustrations, the equipment and mill and shipping facilities of the company, which manufactures corrugated iron bars for reinforced concrete work.

* * *

The Reinforced Rail Joint Company, 1430 Syndicate Trust Bldg., St. Louis, has published an attractive catalogue. A description of the fundamental features of design of the Roach reinforced track joint, and of the Roach insulated joint, is given. Illustrations are shown in explanation of the descriptions and showing the joints in service in the track.

* * *

The latest catalogue of the Merillat Culvert Core Co., Winfield, Ia., gives tabulated costs of concrete culverts, constructed by the use of the Merrilat adjustable core, and comparisons with the cost and durability of other types. Views are shown of completed culverts, and of others in use during construction illustrating the advantages of the method used.

* * *

The D. & A. Post Mold Company of Three Rivers, Mich., issues an instructive catalogue on the manufacture of concrete fence posts. Illustrations and descriptions are given of the distinctive features of the D. & A. system, of plants where this system is used, and fences now in service constructed of these posts.

* * *

The General Railway Signal Company, Rochester, N. Y., has recently issued a number of catalogues descriptive of their various products. The profuse illustrations are the features of these books. Bulletin 115-A describes the model 2A signal; 115-B is an article on block signaling for high speed interurban lines; section 1-Aa of the general catalogue refers to model 2 electric locking machine; and bulletin No. 121 describes the Universal Switch Box, Model 5, Form A.

Personals

H. A. Hatch has been appointed division engineer of the A., T. & S. F., with offices at Chanute, Kan., succeeding M N. Wells, resigned. B. F. Gauldin, roadmaster at Kingman, Ariz., succeeds A. Ray as roadmaster at Barstow, Cal. A. Ray succeeds W. F. Perris as roadmaster at San Bernardino, Cal. L. B. Parsons, formerly roadmaster at Needles, Cal., is made roadmaster at Kingman, Ariz., succeeding B. F. Gauldin, transferred. J. A. Rohrer succeeds Mr. Parsons as roadmaster at Needles, Cal.

F. D. Batchelder has been appointed division engineer of

the B. & O. S. W., with offices at Seymour, Ind.; W. C. Bond succeeds W. I. Trench as division engineer at Chillicothe, Ohio, and T. H. Brown succeeds M. L. Thayer as division engineer, with offices at Flora, Ill.

J. W. Strong succeeds C. L. Bennett as supervisor of track of the C. & O. at Quinnimont, W. Va.

Harry Van Gorder succeeds J. Essex as roadmaster, C. & N. W. Ry., at Antigo, Wis. J. H. Parrot succeeds C. W. Baldridge as roadmaster at Redfield, N. D. Geo. Clayton, roadmaster at Sleepy Eye, Minn., has been transferred, succeeding P. H. Jacobs (pensioned), as roadmaster at Winona, Minn. W. J. Daehn has been appointed roadmaster, with office at Tracy, Minn., succeeding Geo. Clayton.

J. L. Nelson succeeds Mr. Algren as roadmaster of the C. G. W. at Rochester, Minn. G. Algren has been appointed roadmaster at Red Wing, Minn.

J. P. Pinson has been appointed assistant engineer of bridges and buildings, C., M. & P. S., at Seattle, Wash.

A. M. Anderson succeeds K. Nelson as roadmaster at Three Forks, Mont., C., M. & P. S. Ry. C. L. Whiting has been appointed roadmaster at East Portal, Mont.

Carl Stradley, locating engineer of the Oregon Short Line, has been appointed chief engineer, with office at Salt Lake City, Utah, succeeding William Ashton, resigned.

Mr. Guy H. Watson has been appointed roadmaster and supervisor of bridges and buildings of the Montpelier & Wells River, succeeding F. E. Dodge, deceased. Mr. Watson will have offices at Montpelier, Vt.

Mr. D. B. Bartholomew, assistant supervisor of signals, Pennsylvania R. R., at Camden, N. J., has been appointed asistant supervisor of signals of the New York division, with offices at Jersey City, N. J.

B. M. McDonald, division engineer of the N. Y. C. & H. R. R. R. at Jersey Shore, Pa., has been appointed division engineer of the Western division, with office at Buffalo, N. Y., succeeding D. L. Sommerville, promoted. J. M. Fitzgerald, assistant signal engineer at Albany, has been appointed engineer maintenance of signals, with office at Albany. J. W. Hackett has been appointed signal supervisor of the Buffalo division, with office at Buffalo. Mr. Hackett succeeds J. Parker, who has been made supervisor of signals of the Western division, office at Rochester, N. Y.

A. E. Harvey, division engineer of the Kansas City Southern, at Mena, Ark., has resigned to become chief engineer of the Metropolitan Street Railway of Kansas City, Mo.

S. S. Morton has been appointed an assistant engineer of the Kansas City Southern, with office at Mena, Ark., succeeding A. E. Harvey, division engineer. C. L. Wallace has been appointed office engineer at Kansas City, Mo.

M. Donahue, roadmaster of the Chicago & Alton, at Bloomington, Ill., has been appointed general supervisor of roadway and structures, with office at Bloomington. This is a new position. The offices of roadmaster and of supervisor of bridges and buildings of the northern and southern divisions have been abolished.

C. E. Knickerbocker, engineer maintenance of way of the New York, Ontario & Western, has been appointed chief engineer in charge of the road department. Mr. Knickerbocker will have offices at Middleton, N. Y.

G. T. Hand, terminal engineer of the Delaware, Lackawanna & Western, at Hoboken, N. J., has been appointed division engineer in addition to his other duties, assuming the duties of E. T. Cantine, resigned. D. Harley, roadmaster of the Utica division at Utica, N. Y., has been transferred to the Syracuse division, with office at Syracuse, N. Y. R. C. Schofield, formerly roadmaster of the Syracuse division, has been transferred to the Utica division.

The Gulf Line is to begin work immediately on some new shops at Ashburn, Ga.

The Western Maryland has bought the block adjoining its main terminal, in Baltimore, Md., and is is announced will build a passenger and freight depot on the site.

The New York Central is reported to have sold bonds to the extent of $45,000 for constructing the approaches of the bridge to be erected at Niagara Falls, N. Y.

The Central of Georgia is considering the remodeling of the present station of Opelika, the work to be done by company employes.

The Northern Pacific, it is reported, will build a $50,000 freight depot at Mandan, N. D.

The Macon, Dublin & Savannah contemplates the construction of a bridge over the Ocmulgee river near Macon, Ga. The cost will be about $225,000.

The Chicago, Rock Island & Pacific has let the contract to A. W. Lane, Chicago, for the building of a one and two-story, 32x200 ft., brick and plaster, $35,000 passenger station, at Chickasha, Okla.

With The Manufacturers

M. E. Lambrauch, Mgr. Chicago Office United States Electric Co., Chicago.

Edward Backus, Sales Mgr., United States Electric Co., Chicago.

RAILWAY STATION SEATING.

The accompanying illustration shows a modern style of settee for railway station waiting room use manufactured by the American Seating Co., Chicago. The settees made by this company may be divided into three general classes, veneer, bolted slat and doweled slat.

"For public use" is another way of saying that an article is to be subjected to severe usage. In the building of our settees attention is given to every detail to insure strength and durability. The simplest and most approved methods of construction have been adopted. The veneer settees are of the nailless pattern, the veneers being let into the frames at the front of the seat and the top of the back. The frames are doweled, glue jointed and screwed together. At the back of the seat at the base of the veneer is placed a 3-in. braced rail which prevents any possible sagging of the veneer and holds the settee absolutely rigid. The arms are not dependent upon the veneer for their fastenings, an extra brace being used at the back to which the arms are secured by bolts.

No. 215. Double Settee, American Seating Co.

Bolted slat settees, which are mostly for outside use, are fastened together with strong bolts which pass through the wood and iron. The slats are bored with countersinks for the bolt heads, set flush. This construction is extremely simple, designed to withstand the hardest possible usage.

The dowel method of joining the woods and irons is economical and effective. This method consists of heavy lugs on the standards over which the slats are mortised, with a continuous ⅛-in. thick steel dowel piercing the slats and lugs. This dowel which pierces the seat from front to rear and the back from the bottom to the top provides a construction of great rigidity, never gets out of order and furnishes greater strength than other fastenings.

CONCRETE MIXER TRANSPORTATION BY AUTOMOBILE.

In order to make prompt delivery of a concrete mixer the Standard Scale & Supply Co. used a new method of handling one of its "Eclipse" machines. A customer at Gary, Ind., had a break-down on a tilting type mixer and it was necessary to have another machine on the job the next morning. The mixer which was mounted on a truck and equipped with a gasoline engine, was too large to conveniently load in an express car, so an automobile moving van was secured and the complete mounted outfit loaded on this van at 6 o'clock in the evening. The next morning at 8 o'clock it was delivered, complete and ready for operation, at Gary, Ind., about 30 miles from Chicago.

The mixer referred to has a capacity of about 100 yards per day and because of the "Eclipse" simple construction it was possible to load the complete outfit without taking it apart and, the machine being of moderate weight, the automobile was able to handle it without any difficulty even on the country roads.

The Standard Scale & Supply Co. makes a specialty of prompt deliveries and rush orders. It carries a large stock at its factory, branch stores and agencies, and has about 25 mounted outfits, ready for immediately delivery, at its Chicago store and ware-rooms, 1341-1347 Wabash Ave.

MECHANICAL COALING STATION.

The balanced bucket type of railway coaling station has been developed to a high degree of efficiency within the last five years, and is now endorsed by many leading railway engineers. We show herewith an illustration of a "Full Cycle Automatic Fuel Station" designed and built by Williams White & Co., Moline, Ill., and equipped with machinery patented and manufactured by them.

The track hopper bucket pits and foundations are made of concrete, reinforced with steel where necessary. Coal is dumped from drop-bottom cars directly into the track hopper, which usually contains from thirty to fifty tons, and is delivered to the bucket from the track hopper through a steel gravity feeder or measuring box which is placed in the opening between the track hopper and bucket pit. This apparatus is very heavy and simple in construction and consists of a steel box with an inclined bottom which rests on steel beams built into the side walls of the bucket pits. It has an undercut gate at the upper end, and an apron at the lower end hinged to the bottom plate. The apron is connected to the gate arms with steel links which cause a reciprocating action between them.

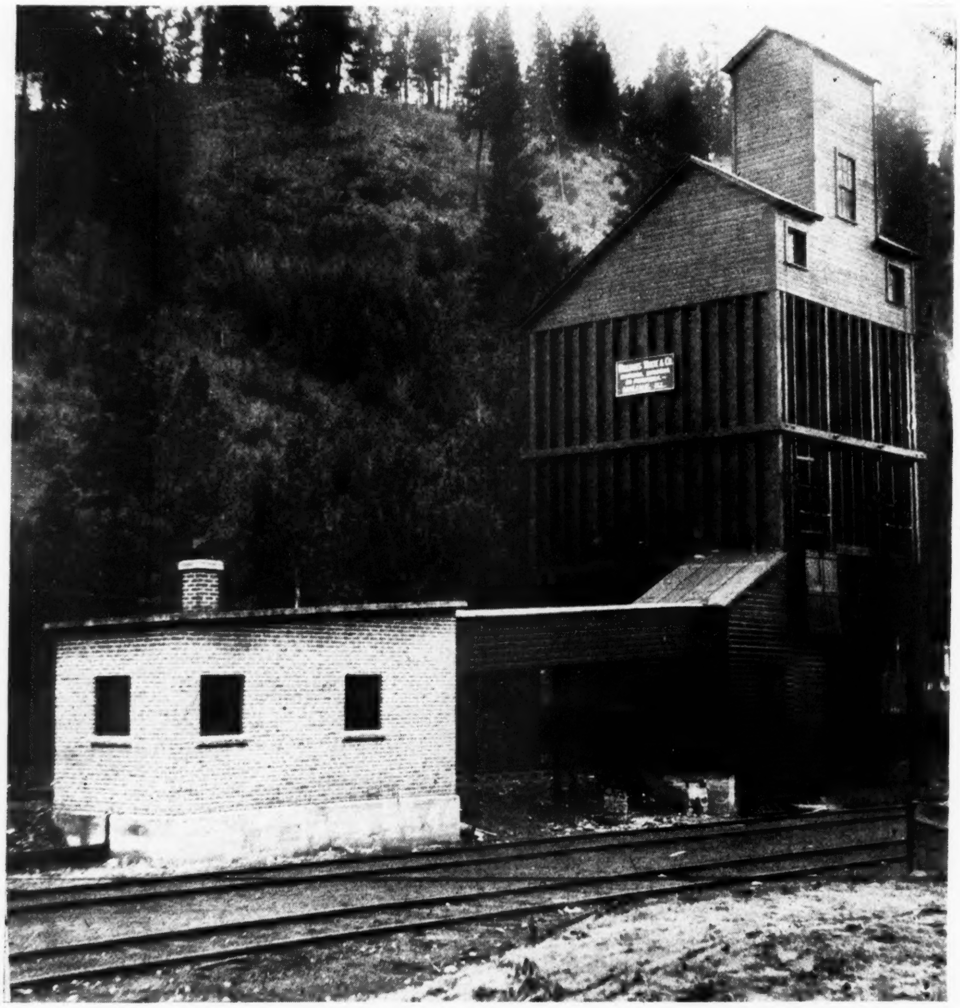
The gate and apron are operated by the movement of the bucket, and the steel connecting links cause the gate to open when the apron closes, and vice versa.

When the bucket decends the steel fingers on the bail engage the rolls on the apron link and open the apron, and

at the same time close the undercut gate at the upper end of the feeder and thus allow the contents of the feeder to flow into the bucket. When the bucket rises it closes the apron at the lower end, opens the gate at the upper end and allows the feeder to refill. It thus insures a full bucket each trip and prevents spilling of coal into pits. The operation of this apparatus requires very little power as the weight of the empty bucket is more than sufficient to open the apron and close the gate. The opening between the track hopper and the feeder has an area of 24 ins. by 46 ins., thus allowing the coal to pass into the feeder very rapidly and preventing the choking or clogging of coal at this point.

The feeder has been thoroughly tested and found entirely satisfactory. The bucket is made of heavey steel plate with rounded bottoms and is carried by trunions attached to each end of the same. It is held in an upright position by latches which are automatically released at the top of the shaft where the bucket tips and discharges its contents into the storage bin.

The buckets are operated by a double belted reversing worm geared hoist which has a bronze gear and steel worm, all enclosed in a dust-proof casing. The steel worm runs in a bath of oil and thus proper lubrication is assured at all times. The hoist being operated by belts from a countershaft which runs constantly in one direction, allows the use of either gasoline, steam or electric motive power. The hoist is equipped with a friction brake that sets automatically whenever the belt is shifted to loose pully. It also has a stop nut on the extended end of the worm shaft which engages a clutch that automatically shifts the belt to the loose pulley at either top or bottom of the shaft. This nut is adjustable and the exact point at which the bucket stops at the top or bottom is easily controlled by adjusting this nut. This arrangement is a positive stop to the bucket and when properly set the point at which the bucket stops either at top or bottom will not vary more than one inch. A safety device is also attached to the drum and, in case the cable gets crossed or slack for any reason, it trips a clutch and the hoist is stopped instantly, setting the brake at the same time.



Coaling Station Built by Williams, White & Co., Northern Pacific Ry.

The plant is also equipped with a belted car puller which enables the operator to easily move the cars either to or from the track hopper. This device eliminates the moving of cars with an engine and requires only the setting in of the loads and removing the empties.

The automatic starter used on these stations, which is patented, is a unique device. It consists of an oscillating pipe capped at both ends and pivoted at the center. The pipe is partially filled with a non-freezing fluid and a sperhical iron ball is placed inside. It is placed underneath the hoist and connected to the belt shifter so that the pipe in oscillating or rocking moves the belt shifter in either direction. The bucket raises the end of the pipe where the ball

is and starts the ball rolling to the other end. When the ball reaches the other end of the pipe it depresses it to such an extent as to shift the belt and the hoist starts in the opposite direction. The length of time necessary for the ball to travel from one end of the pipe to the other regulates the time that the bucket is stationary. This, however, may be varied by moving a button on the cable that operates the pipe so that the ball will travel more slowly and consequently allow more time for the filling and emptying of the bucket.

The advantage of an apparatus of this kind is very apparent to any one familiar with the operation of a coaling plant. In a great many cases it does away with one man or helper, as one operator can easily handle the plant at full capacity if he is provided with drop-bottom or self-clearing cars. The hoisting capacity is from seventy to one hundred tons of coal per hour, depending upon the size of bucket used. There are four sizes of buckets, with capacities of 1, 1¼, 1½, and 2 tons.

With this plant there can be furnished a patented recording delivery chute for measuring and delivering coal from the storage bin to the engine tender, to take the place of scales. It not only measures the amount of coal the engine takes, but it also automatically makes a record of same, and with this appliance any number of engines can take coal at a plant during the night and the operator in the morning can open his box and find a correct record showing the number of engines and the amount of coal taken by each one. It is impossible to take coal from a station equipped with this apparatus without leaving a record. With coal of a fairly uniform size the average variation from the true weight will not be over fifty pounds to the ton, which is close enough for ordinary purposes.

The self-balancing apron is simply a steel-lined wooden apron five feet wide and six feet six inches long, carried on two steel links attached near the center of the apron. The back end of the apron has lugs that travel up and down as the apron is closed or opened. When the apron is not in use it hangs suspended on the steel links close to the side of the station. A hand rope is attached to the top or outer end of the apron by which the engineman may easily pull it into position for coaling. The apron is held closed by gravity and when it is pulled into a horizontal position the weight of the outer end causes it to drop to the proper slope for delivering coal to the tender. At the same time the inside or lower end of the apron is brought in line with the bottom of the storage bin, where it is held by two forged hooks to prevent its going too high. To close this apron, it is only necessary to lift the outer end a little above the horizontal position and its own weight will cause it to swing perpendicularly against the building. There are no latches, chains or counterweights connected with this apron.

Williams White & Co. has been building coal chutes for twenty-three years, and has filled orders for nearly every large railway in the United States. The offices of the company are at Moline, Ill.

Industrial Notes

The use of concrete for culvert purposes is gaining more favor with railroad engineers every day. The Blaw Collapsible Steel Centering Co. of Pittsburg, Pa., has recently equipped several of the largest systems with collapsible steel forms for the building of concrete culverts monolithically and with steel culvert molds for the manufacture of reinforced concrete pipe. The latter method is pursued by having a central station at different points along the line where pipe molds are set up and concrete pipe manufactured.

For the month of March the Detroit Seamless Steel Tubes Co. established a new production record, the tonnage manufactured being 24 per cent larger than in any previous month in its history. A large percentage of the production of this company is used by the railroads for locomotive flues, and the product for the month of March, if placed end to end, would represent a tube about 175 miles long.

The McClintic-Marshall Construction Co. has opened a branch office in the Trussed Concrete building, Detroit, Mich. Mr. R. B. Titsworth is in charge of the office.

The Dailey Construction Co., Evansville, Ind., has been incorporated to do a general construction business, making a specialty of grading roadbeds, laying tracks, building bridges, trestles and culverts, constructing viaducts, subways, terminals, etc. The incorporators are T. J. Dailey, Perth Amboy, N. J.; T. J. Galley, Beeville, Texas, and H. E. Myers, South Bend, Ind.

At a meeting of the stockholders of the Empire Iron & Steel Co., on March 9, the capital stock of the company was increased from $200,000 to $1,000,000. Six additional single puddle furnaces have been added to the "Old-Fashion Iron" department of this company in order to take care of the increasing demand for Empire "Old-Fashion Iron." The officers of the company are: Geo. D. Wick, president; Samuel Siddell, vice-president; J. D. Waddell, treasurer; P. H. Hubbard, secretary, and D. W. Kerr, assistant secretary.

The Whipple Car Co. of Chicago, Ill., has opened an eastern office at 2038 Grand Central Terminal, New York City. Mr. J. H. Burwell, sales agent, will be in charge of the office.

The Transportation Utilities Co., 30 Church St., New York, has been organized to represent directly the Acme Supply Co. and the General Railway Supply Co. of Chicago, Ills. Its territory in the steam railroad field will cover all roads running east of Chicago and St. Louis, and in the electric field and building trades, the United States, Canada and Mexico. Among the devices and materials which it will handle are the following: Steel door, sash and moldings, flexolith composition flooring, metallic (steel) sheathing, Acme, diaphragms, Acme vestibule diaphragm attachment, Acme vestibule curtain roller, Acme weatherstrips, Acme vestibule curtain shield, Acme vestibule curtain hooks, Tuco curtain fixtures and car curtains, National steel trap door and lifting device, National standard roofing, National vestibule curtain catches, Roller deck sash ratchet, Imperial car window screen, Perfection sash balance, Acme vestibule curtain handle. The company will be represented in Baltimore, Md., by Mr. H. B. Chamberlain, located at 704 North Fulton Ave., and in Chicago by Mr. John T. Morton, located at 703 Steger building. The main office of the company will be at No. 30 Church St., New York. Mr. R. M. Campbell, who is well known throughout the East, will be located at the home office.

Geo. B. Swift Company, of Chicago, has recently closed contracts with the Union Pacific for three roundhouses in Wyoming, located respectively at Rock Springs, Laramie and Cheyenne. Also for passenger depots at Ft. Collin, Colo., and Eaton, Colo. Construction on all the above work has been started.

Horace G. Burt was chosen chief engineer by the Association of Commerce of Chicago on the electrification of steam railroads at its weekly meeting in the Union League Club, April 14. The action of the committee followed a report by a subcommittee, of which Dean W. F. Goss of the University of Illinois engineering department was chairman, recommending his selection. Permanent headquarters in the Peoples Gas building, Michigan boulevard and Adams street, were decided upon. The selection of a chief engineer and of permanent quarters completes the preliminary organization of the commission. The selection of officers was made previously, when former Judge Jesse Holdom was made president and Frederick H. Rawson vice-president.

Recent Engineering and Maintenance of Way Patents

AUTOMATIC RAIL-JOINT.

989,683—John Wolfe, Cleveland, Ohio, assignor of one-half to U. S. Metal & Manufacturing Co., New York, N. Y.

This joint consists of two angle bars, and an abutting block on the outside bar. The three parts are fastened together by bolts. Between the outer angle bar and the abutment is a wedge-shaped cam block, which wedges downward between the bar and the abutment, thus automatically taking up the wear and loosening of the joint.

RAILROAD-SPIKE.

989,825—Lee P. Terry, Fairland, Okla.

A railroad spike composed of a body or shank, a head, and an enlarged flat surface to rest on the tie; the part which is to be in contact with the rail is finished off at an angle such that it will rest flat against the base of the rail, if the spike is driven straight. The flat part resting on the tie is designed to resist the outward push of the rail.

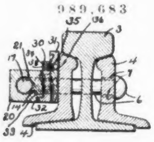
are also fastened rigidly to the base plate, so that there can be no relative movements of these ends to cause interference with the movable rail. The latter is pivoted at one end, and when thrown and held rigidly against one of the guard rails it gives a continuous track for one route; when thrown against the opposite guard rail it gives a continuous track for the other route. The movable frog rail is connected to and moves in conjunction with the switch points.

TIE-PLATE.

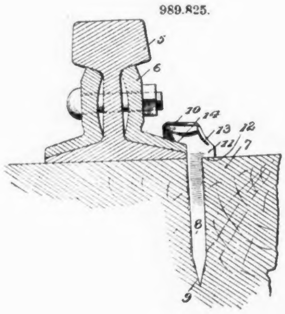
989,321—William T. Bentz, Elyria, Ohio, assignor to Elyria Iron and Steel Co., Elyria, Ohio.

A tie-plate having flanges on its under surface extending longitudinally with respect to and adapted to be embedded in a tie and with grooves on its upper surface extending parallel with said flanges. On the outer edges of the plate are raised bosses of such a height that a screw spike will come to a solid bearing on the rail at the same time that it comes in contact with the raised outer portion of the tie plate.

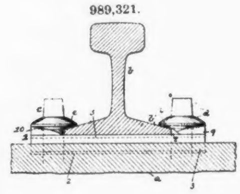
989,683



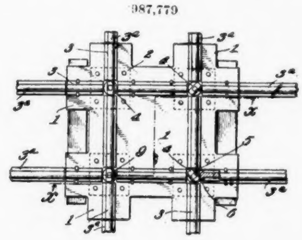
989,825.



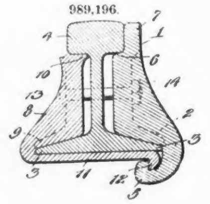
989,321.



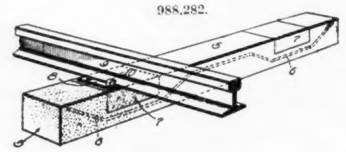
987,779



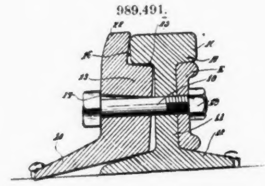
989,196.



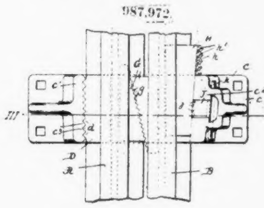
988,282.



989,491.



987,972



RAILROAD FISH-PLATE.

989,196—John G. Shudera, Winona, Minn.

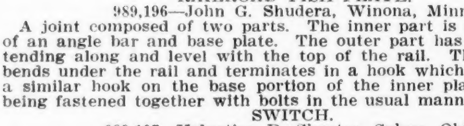
A joint composed of two parts. The inner part is a combination of an angle bar and base plate. The outer part has a portion extending along and level with the top of the rail. The outer plate bends under the rail and terminates in a hook which engages with a similar hook on the base portion of the inner plate, the whole being fastened together with bolts in the usual manner.

SWITCH.

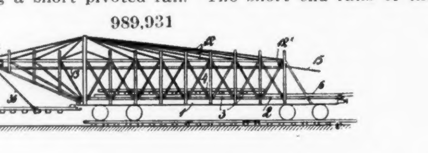
989,197—Valentine D. Shuster, Salem, Ohio.

This is a device to take the place of a rigid frog. There are two guard rails mounted rigidly on a plate, one of these having a recess for receiving a short pivoted rail. The short end rails of the frog

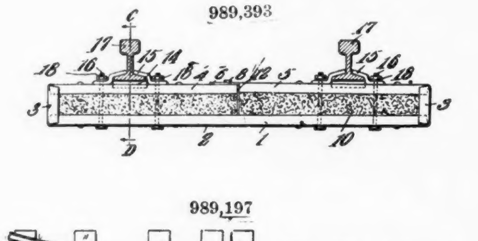
989,931



989,393



989,197



RAILWAY-TIE.

989,393—Marion J. Munson and Samuel V. Whitaker, Stockport, Iowa.

A composite railway tie including metallic side frames, each made up of an angle strip having connected lapping end portions, connections between the frames, and a plastic body interposed between and engaging the frames. The inner body is reinforced with bars imbedded in the material. The rail rests on cushioning blocks which are imbedded into the body of the tie. The rails are held to the tie by lugs held in place by bolts passing entirely through the tie.

TRACK-LAYING MACHINE.

989,931—Carl Gustaf Smith, Stockholm, and Axel Conrad Aulin, Orsa, Sweden.

This track laying machine is made up of a frame work mounted on a car. This frame work supports a track and trolley. The ties for a rail length of track are held properly spaced by a chain work, which is supported on the trolley. The rails are laid on and supported by the ties, and the trolley picks up the whole, carries it out to clear the end of the pioneer cars, drops it to place on the grade, and then releases; the car is then pushed forward and the operation repeated.

FISH-PLATE.

989,491—Daniel Eicher, Brewster, Kans.

This joint consists of inner and outer plates bolted together by bolts passing through the rail. The inner plate is not angled to fit the base of the rail. The outer plate has a long protruding flange, which is designed to engage with the top surface of the tie when the joint is tightened. The outer plate has a lateral elevated portion level with the top of the rail, and resting against the ball of the rail.

CLAMP FOR GUARD-RAILS.

987,972—George M. Ervin, Pen Mar, Pa., assignor to The Lorain Steel Co.

A guard-rail clamp, comprising a clamping-member having converging jaws and a removable chock interposed between one of the jaws and the main rail. The chock has a number of teeth engaging recesses in the adjacent jaw. Between the main and guard rails is a spacing block, composed of two wedged-shaped blocks with teeth to engage with each other.

RAILROAD-CROSSING.

987,779—James A. Walker, Los Angeles, Cal.

A right angle railway crossing consisting of a solid base plate to which the abutting end rails are rigidly fastened. Between the ends of the rails is mounted a pivoting pedestal holding a short rail section. Means are provided for turning the pedestal and short piece of rail into alignment with and to fill the gaps in either track.

RAILROAD-TIE.

988,282—Raymond G. Osborne, Los Angeles, Cal.

A rail tie, comprising a body portion of cementitious material containing a cement binder and a filling of rocky substance, and a rail supporting portion composed of cementitious material containing a cement binder and a filling of finely divided wood. The cement binder of finely divided wood is under the rail and is designed to give high resiliency.

11.

no
the
wn
in-
ard
ble
tch

von

gi-
nd
aid
n a
ail
ter

wa.
nde
on-
een
ars
eks
to
tie.

in,

ted
ies
rk,
up-
it
the
the

by
fit
ge,
nen
or-
of

ain

on-
the
ng
is
eth

to
the
ort
ort
rk.

ial
l a
in-
ent
to